

## GENERAL SPECIFICATION

### ROTATING MACHINERY

#### GS EP MEC 281

**Lubrication, Shaft Sealing, and Oil Control Systems  
and Auxiliaries according to ISO 10438 /  
API Standard 614**

|      |         |                         |
|------|---------|-------------------------|
|      |         |                         |
| 10   | 10/2012 | Update of the Part 4    |
| 09   | 01/2012 | Update                  |
| 08   | 01/2011 | Update                  |
| 07   | 10/2009 | Update                  |
| 00   | 01/2011 | First issue             |
| Rev. | Date    | Purpose of the revision |

Owning entity: DEV/TEC

Managing entity: DEV/TEC/MTH



| General Specification                                                                                            |                         | GS EP MEC 281  |
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| Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries<br>according to ISO 10438 / API Standard 614 |                         |                |
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## 1. Scope

The purpose of this specification is to clarify the requirements of [ISO 10438/API Std 614](#) standard Fifth edition, April 2008 and Errata May 2008.

Technical proposal shall be supported by DS EP MEC 281 part of the Appendix B of this specification.

This document modifies or complements some requirements of [ISO 10438/API Std 614](#) standard, when deemed necessary considering Company experience.

The paragraph numbering is identified in the same way as in [ISO 10438/API Std 614](#) except for additional requirements, which may be presented with new paragraph numbers. The summary sheet at front indicates where to find the information for each paragraph of [ISO 10438/API Std 614](#) shown with a bullet.

## 2. Reference documents

The reference documents listed below form an integral part of this General Specification.

### External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

| Reference                                    | Title                                                                                                                                         |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <a href="#">API Std 614</a>                  | Lubrication, shaft-sealing, and Oil-control Systems and Auxiliaries                                                                           |
| <a href="#">API Std 661</a>                  | Air-Cooled Heat Exchangers for General Refinery Service                                                                                       |
| <a href="#">API Std 675</a>                  | Positive Displacement Pumps - Controlled Volume                                                                                               |
| <a href="#">ASME VIII Division 1</a>         | Boiler and Pressure Vessel Code                                                                                                               |
| <a href="#">ASTM E 1003</a>                  | Standard Test Method for Hydrostatic Leak Testing                                                                                             |
| <a href="#">ISO 10438 (Parts 1; 2; 3; 4)</a> | Petroleum, petrochemical and natural gas industries - Lubrication, shaft-sealing and oil-control systems and auxiliaries - (Parts 1; 2; 3; 4) |
| <a href="#">ISO 13709</a>                    | Centrifugal pumps for petroleum, petrochemical and natural gas industries                                                                     |
| <a href="#">ISO 5199</a>                     | Technical specifications for centrifugal pumps - Class II                                                                                     |
| <a href="#">ISO 80000-1:2009</a>             | Quantities and units                                                                                                                          |



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Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

| Reference     | Title                                                         |
|---------------|---------------------------------------------------------------|
| GS EP INS 107 | Design and installation of instrumentation links (Appendix 3) |
| GS EP MEC 101 | Driver Power Sizing                                           |
| GS EP PVV 112 | Piping material classes                                       |

### 3. Comments to [ISO 10438-1/API Std 614](#)

#### Part 1 - General Requirements

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                | GS                                                                                                                                                                                                                                                                                                   |
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| <b>1. Scope</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                      |
| <b>1.1 New paragraph</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Oil systems shall be supplied in accordance with the standards <a href="#">ISO 10438/API Std 614</a> . Vendor shall clearly indicate and submit in his proposal any deviation to this standard and this document.                                                                                    |
| <b>2. Normative references</b>                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                      |
| The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.                                                                                                                                                                                                               | <b>Clarification</b><br>Any amendments to reference documents shall be submitted to Company for review.                                                                                                                                                                                              |
| <b>4. General</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                      |
| <b>4.1 Dimensions and Units</b>                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                      |
| Drawings and maintenance dimensions shall be in SI units or United States customary (USC) units.<br>Use of an SI datasheet indicates that SI units shall be used.<br>Use of an USC datasheet indicates that USC units shall be used.<br><b>Note:</b> Dedicated datasheets for SI units and for USC units are provided in Appendix B in each of the four parts of ISO 10438.                                                                                              | SI units data sheets that indicates that SI units shall be used.<br>The SI system of units ( <a href="#">ISO 80000-1:2009</a> ) shall be used in all technical documents, drawings, design notes, etc., prior to or following the order, except with regard to the names of NPT taper screw threads. |
| <b>4.3 System selection</b>                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                      |
| <ul style="list-style-type: none"> <li><b>4.3.1</b> Annexes in ISO 10438-2, ISO 10438-3 and ISO 10438-4 provide schemas and diagrams of typical complete lubrication, oil-type shaft-sealing, dry gas face-type shaft-sealing and control-oil systems. These schematics and diagrams illustrate the general philosophy and requirements of this part of ISO 10438 and are included to assist the purchaser in the selection of an appropriate system. Symbols</li> </ul> | <b>Addition</b><br>Vendor's proposal shall clearly include details of the proposed oil systems schematics and diagrams. Any others symbols necessary for purchaser understanding shall comply with ISA standards.                                                                                    |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | GS                                                                                                                                                |
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| shown on these schematics and diagrams are identified in Annex B of this part of ISO 10438. The purchaser and the Vendor shall agree upon a mutually acceptable system before the order is released.                                                                                                                                                                                                                                                                                                              |                                                                                                                                                   |
| <ul style="list-style-type: none"> <li><b>4.3.4</b> The purchaser shall define the scope of supply, the level of quality or the brand of components, the system type, the general arrangement (including plan and elevation views of the console orientation), the space available for the console, the service (special purpose or general purpose) and other requirements. Annexes C and D of this part of ISO 10438 are intended to assist in this definition.</li> </ul>                                      | Oil systems come under the responsibility of the rotating equipment Manufacturer or the Vendor who has the full responsibility of the shaft line. |
| <b>4.4 Pressure design code</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                   |
| <ul style="list-style-type: none"> <li>The pressure design code shall be specified or agreed by the purchaser. Pressure components shall comply with the pressure design code and the supplementary requirements in this part of ISO 10438.</li> </ul>                                                                                                                                                                                                                                                            | <a href="#">ASME VIII Division 1</a> and/or PD 5500 shall be applied.                                                                             |
| <b>4.5 Basic design</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                   |
| <ul style="list-style-type: none"> <li><b>4.5.2</b> The equipment, including all auxiliaries, shall be suitable for operation under the environmental conditions specified. These conditions shall include whether the installation is indoors (heated or unheated) or outdoors (with or without a roof), maximum and minimum temperatures, unusual humidity, and dusty or corrosive conditions.</li> </ul>                                                                                                       | According to Projects specifications and data sheets.                                                                                             |
| <b>4.6 Welding</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                   |
| <ul style="list-style-type: none"> <li><b>4.6.2</b> In addition to the requirements of 4.6.1 and the applicable piping code, the purchaser may specify that additional radiography, magnetic particle inspection or liquid-penetrant inspection of specific welds on equipment and/or piping is required.</li> </ul> <p><b>Note 1:</b> ISO 15649 already includes a level of NDT inspection for piping.</p> <p><b>Note 2:</b> ISO 10438-3 systems do not require radiography of piping (see ISO 10438-3:2007,</p> | According to Project specifications.                                                                                                              |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
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| 5.1.2).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>5. Piping</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>5.1 General</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <p><b>5.1.2</b> Auxiliary systems are defined as piping systems that are in the following services:</p> <p>a. Group I, Auxiliary process fluids (see Table 1):</p> <ol style="list-style-type: none"> <li>1. Sealing fluid</li> <li>2. Gland and flushing fluid</li> <li>3. Recirculation fluid</li> <li>4. Balance gas</li> <li>5. Buffer gas</li> <li>6. Fuel gas or oil</li> <li>7. Drains and vents associated with Group I systems</li> <li>8. Starting gas</li> <li>9. Separation gas</li> <li>10. Solvents Injection</li> </ol> <p>b. Group II, steam and air (see Table 2):</p> <ol style="list-style-type: none"> <li>1. Sealing steam</li> <li>2. Steam injection</li> <li>3. Water injection</li> <li>4. Starting air</li> <li>5. Instrument and control air</li> <li>6. Drains and vents associated with Group II systems</li> </ol> <p>c. Group III, Cooling water (see Table 3):</p> <ol style="list-style-type: none"> <li>1. Cooling water</li> <li>2. Liquid wash (water based)</li> <li>3. Drains and vents associated with Group III systems</li> </ol> <p>d. Group IV (see Table 1D)</p> <ol style="list-style-type: none"> <li>1. Lubricating oil</li> <li>2. Control oil</li> <li>3. Seal oil (see 5.4 for seal oil contaminated with process fluid)</li> <li>4. Drains and vents associated with Group</li> </ol> | <p><b>Modification</b></p> <p>Table 1, 2, 3 and 4 are applicable with the following <b>modifications</b>.</p> <p><b>Company piping classes <span style="color: red;">GS EP PVV 112</span> shall apply whatever the fluid considered.</b></p> <p>Pipe and pipe fitting: Schedule shall be selected from <span style="color: red;">GS EP PVV 112</span>. Weld neck shall be use only for NPS above 1 ½ inch, socket weld shall be use for NPS under 1 ½ inch. Threaded connections are not permitted for flammable and toxic gas.</p> <p>Flanges: Weld neck shall be used only for NPS above 1 ½ inch, socket weld shall be use for NPS under 1 ½ inch. Schedule shall be selected from <span style="color: red;">GS EP PVV 112</span></p> <p>Tubing and tube fittings: Shall be in compliance with <span style="color: red;">GS EP INS 107</span> Appendix 3. Use of tubing and tube fittings shall be only limited to the instruments links</p> <p>Gaskets: Only spiral wound with non asbestos filler shall be used whatever the class selected.</p> <p>Flange boltings: material selection shall prevent seizing.</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | GS                                                                                                                                                                                                                             |
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| <p>IV systems</p> <p>Auxiliary systems shall comply with the requirements of Tables 1 to 6, except as modified in referencing standards, including references to Tables 1 through 6 in ISO 10438-2, ISO 10438-3 and ISO 10438-4.</p>                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                |
| <ul style="list-style-type: none"> <li>• <b>5.1.4</b> The Vendor shall furnish all piping systems, including mounted appurtenances, located within the confines of the main unit's base area, any oil console base area or any auxiliary base area. The piping shall terminate with flanged connections at the edge of the base. When soleplates are specified for the equipment train, the extent of the piping system at the equipment train shall be defined by the purchaser. The purchaser shall furnish only interconnecting piping between equipment groupings and off-base facilities.</li> </ul> | <p>Piping shall terminate with flanges connections, according to Company piping classes (refer to <b>GS EP PVV 112</b>), at skid edge, except for liquid wash which are generally provided with quick coupling connectors.</p> |
| <ul style="list-style-type: none"> <li>• <b>5.1.18</b> Special requirements for piping, flanges, gaskets, instruments and o-rings, valves and other appurtenances in special and/or hazardous service shall be specified by the purchaser.</li> </ul>                                                                                                                                                                                                                                                                                                                                                     | <p>If any, it shall be specified in Project specifications, otherwise Vendor specifications will be applied.</p>                                                                                                               |
| <p><b>5.1.27</b> If specified, test valves shall be supplied adjacent to all of the instruments. Test valves shall terminate with a plugged DN 15 (NPS 112) connection (5.1.25). If specified, test valves in oil lines shall be vented back to the reservoir. Test valves may be combined with instrument valves supplied in accordance with 5.1.24.</p>                                                                                                                                                                                                                                                 | <p>Instruments shall always be provided with instrument valve including drain, vent and test port. These functionalities may be incorporated in a single manifold assembly. Drain shall always be back to the reservoir.</p>   |
| <ul style="list-style-type: none"> <li>• <b>5.1.30</b> If specified, each utility such as air and inert-gas supply, cooling water supply and return lines and others as specified shall be manifolded to a common connection.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                  | <p>This paragraph is applicable.</p>                                                                                                                                                                                           |
| <ul style="list-style-type: none"> <li>• <b>5.1.32</b> If specified, valves shall be in accordance with purchaser-specified standards in addition to the mandated requirements of this part of ISO 10438.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                      | <p>If any, it shall be specified in Project specifications, otherwise Vendor specifications will be applied.</p>                                                                                                               |
| <ul style="list-style-type: none"> <li>• <b>5.1.33</b> If specified, flanged gate valves shall be in accordance with ISO 10434 and ISO 15761 in addition to the mandated</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>This paragraph is applicable.</p>                                                                                                                                                                                           |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | GS                                                                                                                                                                                                                                                                                  |
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| requirements of this part of ISO 10438.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                     |
| <b>5.4 Process piping</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                     |
| <ul style="list-style-type: none"> <li><b>5.4.1</b> The extent of, and requirements for, process piping to be supplied by the Vendor shall be specified.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                     | Vendor shall provide all required process piping -internal to its package- for dry gas seals system and compressor companion flanges according to <b>GS EP PVV 112</b> piping classes. The companion flanges drawings shall be submitted to Company and/or Contractor for approval. |
| <ul style="list-style-type: none"> <li><b>5.4.2</b> If specified, the Vendor shall review all piping, appurtenances (pulsation suppression devices, intercoolers, aftercoolers, separators, knockout drums, air intake filters, expansion joints) and supports immediately upstream and downstream of the equipment and supports. The purchaser and the Vendor shall mutually agree on the scope of this review.</li> </ul>                                                                                                                                                                             | This paragraph is applicable, the extent of the Vendor scope shall only be the review and the advice of herewith stated.                                                                                                                                                            |
| <b>5.5 Intercoolers and aftercoolers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                     |
| <ul style="list-style-type: none"> <li><b>5.5.1</b> When specified, the Vendor shall furnish an intercooler between each compression stage.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                  | If any, according to Project specifications.                                                                                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li><b>5.5.2</b> Intercoolers shall be air-cooled or water-cooled as specified.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | If any, according to Project specifications.                                                                                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li><b>5.5.3</b> The purchaser shall specify whether aftercoolers shall be furnished by the Vendor.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | If any, according to Project specifications.                                                                                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li><b>5.5.5</b> Water-cooled, shell-and-tube intercoolers and aftercoolers shall be designed and constructed in accordance with TEMA Class C or R, as specified. When TEMA Class R is specified, the heat exchanger shall be in accordance with ISO 16812 as specified.</li> </ul> <p><b>Note 1:</b> It is necessary to exercise caution regarding the susceptibility of heat exchangers and their supporting structures to pulsation-induced vibration.</p> <p><b>Note 2:</b> For the purposes of this provision, ANSI/API Std 660 is equivalent to ISO 16812.</p> | If any, according to Project specifications and data sheets.                                                                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li><b>5.5.10</b> If specified, water-cooled double-</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | If any, according to Project specifications and                                                                                                                                                                                                                                     |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | GS                                                                                                                                                                                                              |
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| pipe intercoolers and aftercoolers shall be furnished. A finned double-pipe design may be furnished only when specifically approved by the purchaser.                                                                                                                                                                                                                                                                                                                                 | data sheets.                                                                                                                                                                                                    |
| <ul style="list-style-type: none"> <li>• <b>5.5.11</b> Intercoolers shall be either integrally mounted on a skid or separately mounted, as specified.</li> </ul>                                                                                                                                                                                                                                                                                                                      | If any, according to Project specifications and data sheets.                                                                                                                                                    |
| <ul style="list-style-type: none"> <li>• <b>5.5.12</b> Materials of construction shall be those specified.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                 | According to Project specifications and data sheets.                                                                                                                                                            |
| <ul style="list-style-type: none"> <li>• <b>5.5.14</b> If specified, the Vendor shall furnish the fabricated piping between the compressor stages (or the nozzles of centrifugal compressor bodies) and the intercoolers and aftercoolers. Interstage piping shall conform to the piping design code (e.g. ISO 15649).</li> </ul>                                                                                                                                                     | According to Project specifications and data sheets.                                                                                                                                                            |
| <b>6. Instrumentation, Control and Electrical Systems</b>                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                 |
| <b>6.1 General</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Instrumentation, control, electrical systems and installation shall comply with the applicable Contract specifications.                                                                                         |
| <b>6.2 Alarm, shutdown and control systems</b>                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                 |
| <b>6.2.1 General</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                 |
| <ul style="list-style-type: none"> <li>• <b>6.2.1.2</b> If specified, shutdown-sensing devices shall be provided with valving, bridging links or other approved protocol to allow replacement with the equipment in operation. Isolation valves for shutdown-sensing devices shall be provided with a means of locking the valves in the open position.</li> </ul>                                                                                                                    | This paragraph is applicable.                                                                                                                                                                                   |
| <ul style="list-style-type: none"> <li>• <b>6.2.1.3</b> If specified, a hand-auto (HA) or hand-off-auto (HOA) starting switch for the pump motor(s) shall be provided. The HA switch shall contain manual-on and automatic-start positions only, with a separate manual reset button. When an HOA switch is provided, there shall be a separate set of contacts to indicate or alarm that it is in the off position.</li> </ul> <p><b>Note:</b> The manual reset button of the HA</p> | Refer to Project specifications, if any, remote station shall only include a start button and the reset button shall be replaced by mushroom type emergency button embedded protection and with locking device. |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | GS                                                                                                                                                                          |
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| <p>control allow the standby pump to be manually shut down while the switch is in the automatic-start position only if the primary pump is providing sufficient pressure (that is, if the pressure-rising limit relay of the low-pressure switch (PSL) has been satisfied).</p> <p>A separate electrical disconnect switch with a lockable off position should be provided at a remote location and should be used only for pump maintenance or during the time the equipment is shut down. This is normally accomplished in the motor control center.</p>                                                                                                                                                                |                                                                                                                                                                             |
| <b>6.2.2 Alarm and shutdown systems</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                             |
| <ul style="list-style-type: none"> <li>• <b>6.2.2.2</b> The purchaser shall specify the alarms and shutdowns required which, as a minimum, should include those listed in ISO 10438-2:2007, Table 1; ISO 10438-3:2007, Table 3; ISO 10438-4:2007, Table 1.</li> </ul> <p><b>Note:</b> Guidance for the use of various specified arrangements can be found in IEC 61511 (all parts).</p>                                                                                                                                                                                                                                                                                                                                   | <p>Refer to Project specifications and Project data sheets for minimum requirements.</p>                                                                                    |
| <ul style="list-style-type: none"> <li>• <b>6.2.2.4</b> The purchaser shall specify the extent to which alarm/shutdown systems are supplied and installed by the equipment Vendor.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>Refer to Project specifications and Project data sheets for minimum requirements.</p>                                                                                    |
| <p><b>6.2.2.5</b> Unless otherwise specified, the alarm/shutdown system shall comply with the following requirements.</p> <ul style="list-style-type: none"> <li>• b) Any alarm parameter, reaching the alarm point, shall initiate an audible warning or flashing light or both, as specified. It shall be possible to determine which parameter initiated the alarm.</li> <li>• c) Any shutdown parameter, reaching the shutdown point, shall cause the equipment to shutdown and shall initiate an audible warning or a flashing light or both, as specified, which shall be distinguishable from those associated with an alarm. It shall be possible to determine which parameter initiated the shutdown.</li> </ul> | <p>b) It shall be configured on UCP/HMI, first out indicator is always mandatory.</p> <p>c) It shall be configured on UCP/HMI, first out indicator is always mandatory.</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | GS                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| <b>6.2.3 Alarm and shutdown arrangements</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <ul style="list-style-type: none"> <li>Alarm and shutdown arrangements shall be one of the following as specified.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>6.2.3.1 Arrangement 1</b><br>Both shutdown and alarm switches shall be connected through normally energized, fail-safe circuits. The shutdown circuit wiring shall be completely independent from the alarm circuit wiring and shall be mechanically protected.                                                                                                                                                                                                                                                                                                                                                                                                                                           | Arrangement 1 is not applicable.                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>6.2.3.2 Arrangement 2</b><br><b>6.2.3.2.1</b> Shutdown functions shall be initiated by local, direct-acting switches connected in a normally de-energized circuit.<br><b>6.2.3.2.2</b> Alarm functions shall be comprised of locally mounted transmitters (electronic or pneumatic, as specified) connected to either separate, panel-mounted switches or to a multi-point, scanning-type monitor.<br><b>6.2.3.2.3</b> Where multi-point, scanning-type monitors are used, the alarm setting for each function shall be separately and independently adjustable.                                                                                                                                          | Arrangement 2 is not applicable.                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>6.2.3.3 Arrangement 3</b><br><b>6.2.3.3.1</b> Each function for which both an alarm and a shutdown have been specified shall be provided with three separate and independent transmitters (electronic unless agreed to otherwise). The detail arrangement should be jointly developed between the purchaser and the Vendor or Vendors of the system and the served equipment.<br><b>6.2.3.3.2</b> Each transmitter shall be independently connected to one of three independent, multi-points, electronic, scanning-type monitors for each transmitter input.<br><b>6.2.3.3.3</b> The shutdown and alarm function outputs from the three instruments shall be connected through "two-out-of-three" voting | Arrangement 3 is applicable with following clarifications.<br><br>Only two separate and independent transmitters shall be provided with separated impulse lines whenever possible.<br><br>Transmitters shall electronic intelligent HART protocol type, 4-20 mA output signals. The arrangement shall be as per Manufacturer standard. Transmitters shall always be supported from brackets.<br><br>This paragraph is not applicable. |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | GS                                                                                                                                                                                                  |
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| <p>logic and shall allow the operation of any one alarm or shutdown function to initiate an alarm. Operation of two shutdown functions monitoring the same parameter initiates a separate alarm and shall cause the served equipment to shutdown. If any one transmitter is faulty, then the remaining two transmitters vote "one-out-of-two" for shutdown. If a second transmitter becomes faulty, then the system shuts down the served equipment.</p> <p><b>6.2.3.3.4</b> Alarm functions not associated with a shutdown function shall be provided with one single transmitter. The detailed arrangement should be jointly developed by the purchaser and the Vendor or Vendors of the system and the served equipment.</p> <p><b>Note:</b> This arrangement (Arrangement 3) has the following advantages.</p> <p>a) Any shutdown or alarm function can be tested at any time with the equipment in service without the need to disarm any part of the system.</p> <p>b) Failure of any one component initiates an alarm but does not result in equipment shutdown.</p> <p>c) The use of modem, digital instrument technology is facilitated.</p> | <p>This paragraph is applicable.</p>                                                                                                                                                                |
| <b>6.2.4 Annunciators</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                     |
| <ul style="list-style-type: none"> <li><b>6.2.4.1</b> If specified, the Vendor shall provide a <b>console-gauge-board-mounted</b> and/or a control-panel mounted annunciator.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <p>Console gauge board shall be replaced by transmitters fitted with analog display.</p> <p>Annunciator shall be provided and installed in UCP (Unit Control Panel) located in instrument room.</p> |
| <ul style="list-style-type: none"> <li><b>6.2.4.2</b> The Vendor shall furnish a first-out annunciator when an annunciator system is specified. The annunciator shall contain a minimum of 25% spare points and, if specified, shall be arranged for purging. A summary (or common) output circuit shall be provided, as a minimum, for actuation of a remote signal when any function alarms or trips. The sequence of operation shall be as specified below.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>This paragraph is fully applicable without any restriction.</p>                                                                                                                                  |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | GS                                                                                                                                                          |
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| <p>a) The first parameter to reach alarm or shutdown shall cause the flashing of a light and the sounding of an audible device.</p> <p>b) The alarm or shutdown condition shall be acknowledged by operating an alarm silencing button, common to all alarms and shutdowns.</p> <p>c) When the alarm or shutdown is acknowledged, the audible device shall be silenced but the light shall remain steadily lit as long as that alarm or shutdown condition exists.</p> <p>d) If another parameter reaches an alarm or shutdown level the light shall return to the flashing condition and the audible device shall sound, even if the previous alarm/shutdown condition has been acknowledged but still exists.</p> |                                                                                                                                                             |
| <ul style="list-style-type: none"> <li>• <b>6.2.4.3</b> If specified, the annunciator sequence shall be selected from ISA 18.1 by the purchaser.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Annunciator system shall be built in the UCP (HMI) though PLC logic with first out indication flashing, audible alarm, manual acknowledge and manual reset. |
| <ul style="list-style-type: none"> <li>• <b>6.2.4.4</b> If specified, a separate first-out indication shall be provided.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | A separate first out indication shall be part of the logic and shall be implemented in the UCP (HMI), no others configuration are requested.                |
| <b>6.3 Instrumentation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                             |
| <b>6.3.1 Instrument installation and gauge boards</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                             |
| <b>6.3.1.1</b> Instruments for the console, gas seal module and equipment may be local or gauge-board mounted as specified.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Instruments for the console, gas seal module and equipment shall be local and gauge-board mounted.                                                          |
| <ul style="list-style-type: none"> <li>• <b>6.3.1.3</b> If specified, a common panel shall be provided and shall include all panel-mounted instruments for the driven equipment and the driver. Such panels shall be designed and fabricated in accordance with the purchaser's description. The panel shall be freestanding, located on the base of the package or machine base-plate or in another location, as specified. The instruments on the panel shall be clearly visible to the operator from the driver control location. A lamp test push button shall be provided if the panel contains indication lamps.</li> </ul>                                                                                   | This paragraph is applicable except the provision of lamp test and indicating lamps.                                                                        |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | GS                                                                                                                                                                                                                                                                                                                                                                                            |
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| The instruments mounted on the panel shall be specified. Wiring inside of the panel shall be nearly run in wire ducting.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The instruments shall be wired to junction boxes located at skid edge. The use of ducting shall be only for 316 SS flexible conduits, all other ducting shall be made of 316 SS cables trays with solid 316 SS covers.                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li><b>6.3.1.4</b> Unless otherwise specified, panel fronts shall be made of steel plate at least 3 mm (118 in) thick, reinforced, self-supporting and closed on the top and sides. Tops and sides shall be a minimum of 12 gauges. If specified, panels shall be totally enclosed to minimize electrical hazards, to prevent tampering or to allow purging for safety or corrosion protection. All instruments shall be mounted flush on the front of the panel and all separate fasteners shall be of corrosion-resistant metal. All interior and exterior surfaces of carbon steel panels shall be suitably prepared and coated with an industrial grade painting system.</li> </ul> | <p>Panel front shall be made of 316 SS minimum grade, self supporting, and enclosed on the top and side wherever possible. All instruments shall be 316 SS external body including a display and shall be low voltage certified ATEX Ex II 2G and CE marked (Zone 1, temperature class T3), certified panel don't need to be fully enclosed.</p> <p>Painting is not required over 316 SS.</p> |
| <ul style="list-style-type: none"> <li><b>6.3.1.5</b> Panel-mounted and <b>console-gauge-board-mounted</b> instruments shall be specified by the purchaser.<br/>(See datasheets for an equipment instrumentation list.)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Panel shall be with 316 SS certified transmitters ATEX Ex II 2G and CE marked (Zone 1, temperature class T3) including display. Dial gauge board is not necessary.                                                                                                                                                                                                                            |
| <p><b>6.3.1.7</b> When more than one wiring point is required on a unit for control or instrumentation, the wiring to each electrical control device or instrument shall be provided from common terminal boxes with terminal posts.</p> <p>Unless otherwise specified, multiple terminal boxes are required for segregation of different AC and DC electrical signals.</p>                                                                                                                                                                                                                                                                                                                                                | <p><b>Clarification</b></p> <p>Multiple terminal boxes are requested for segregation between:</p> <ul style="list-style-type: none"> <li>AC Low voltage (110 and/or 400 VAC)</li> <li>DC very low voltage (24 and/or 48 VDC)</li> <li>Explosion proof Instrumentation</li> <li>Intrinsically safe circuits.</li> </ul>                                                                        |
| <ul style="list-style-type: none"> <li><b>6.3.1.8</b> If specified, signal-segregation requirements in addition to the requirements defined in 6.3.1.7 shall be provided.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>Segregation shall as a minimum between:</p> <ul style="list-style-type: none"> <li>AC Low voltage (110 and/or 400 VAC)</li> <li>DC very low voltage (24 and/or 48 VDC)</li> <li>Explosion proof Instrumentation</li> <li>Intrinsically equaly safe circuits.</li> </ul>                                                                                                                    |
| <ul style="list-style-type: none"> <li><b>6.3.1.10</b> All wiring shall be installed in metal conduits, cable trays or enclosures, as</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p><b>Clarification</b></p> <p>Metal conduits are not allowed, only 316 SS</p>                                                                                                                                                                                                                                                                                                                |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                          | GS                                                                                                                                                                                                                                                                                                                                                        |
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| specified.                                                                                                                                                                                                                                                                                                                                                                                                                                         | minimum grade cable trays including covers shall be used                                                                                                                                                                                                                                                                                                  |
| <b>6.3.2 Switches</b>                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                           |
| <ul style="list-style-type: none"> <li>• <b>6.3.2.4</b> The purchaser shall specify whether switches shall be connected to either open (de-energize) or close (energize) to initiate alarms and shutdowns.</li> </ul>                                                                                                                                                                                                                              | Switches are no more admitted and shall be replaced by ladder logic built in processor logic controller. Logic shall always build in fail safe circuits.                                                                                                                                                                                                  |
| <ul style="list-style-type: none"> <li>• <b>6.3.2.6</b> If specified or approved, multi-point instruments may be used, except that alarms and shutdowns shall be connected to separate instruments, and separate alarm or shutdown contacts (switches) shall be provided. Each alarm and shutdown level shall be separately adjusted.</li> </ul>                                                                                                   | This paragraph is not applicable.                                                                                                                                                                                                                                                                                                                         |
| <b>6.3.3 Transmitters</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                           |
| <ul style="list-style-type: none"> <li>• <b>6.3.3.1</b> If specified transmitters shall be provided.</li> </ul>                                                                                                                                                                                                                                                                                                                                    | Transmitters shall always be provided.                                                                                                                                                                                                                                                                                                                    |
| <ul style="list-style-type: none"> <li>• <b>6.3.3.2</b> The purchaser shall specify output signal type, indicating or non-indicating (blind) type, housing type and power supply requirements.</li> </ul>                                                                                                                                                                                                                                          | Transmitters shall be: <ul style="list-style-type: none"> <li>• Hart protocol design electronic intelligent type</li> <li>• 4-20 mA output</li> <li>• 24 VDC or 48 VDC input supply</li> <li>• Certified ATEX Ex II 2G and CE marked (Zone 1, temperature class T3)</li> <li>• 316 Stainless steel housing</li> <li>• Indicating display type.</li> </ul> |
| <ul style="list-style-type: none"> <li>• <b>6.3.3.3</b> Transmitters shall be of analogue or digital type, as specified.</li> </ul>                                                                                                                                                                                                                                                                                                                | Refer to above comments in 6.3.3.2.                                                                                                                                                                                                                                                                                                                       |
| <ul style="list-style-type: none"> <li>• <b>6.3.3.4</b> The purchaser shall specify transmitters that are non-hazardous, non-incentive, explosion-proof or intrinsically safe (IS), as required by the electrical area classification.</li> </ul> <p><b>Note:</b> Transmitters for normally hazardous electrical area classifications can be satisfied by more than one transmitter configuration, i.e. intrinsically safe or explosion proof.</p> | Refer to above comments in 6.3.3.2.<br><br>Note is applicable.                                                                                                                                                                                                                                                                                            |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | GS                                                                                                                                                         |
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| <b>6.3.8 Pressure indicators</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                            |
| <ul style="list-style-type: none"> <li><b>6.3.8.1</b> Pressure indicators shall be located per the datasheets.</li> </ul> <p><b>Note:</b> This refers to local indication of pressure and can be accomplished by indicators and/or pressure indicating transmitters.</p>                                                                                                                                                                                                              | Refer to Project data sheets for compliance with the extend of supply.                                                                                     |
| <ul style="list-style-type: none"> <li><b>6.3.8.3</b> If specified, liquid-filled gauges or dampened movement gauges shall be furnished in locations subject to vibration.</li> </ul>                                                                                                                                                                                                                                                                                                 | This paragraph is applicable.                                                                                                                              |
| <ul style="list-style-type: none"> <li><b>6.3.8.6</b> The Vendor shall supply all pressure indicators and transmitters as defined on the datasheets.</li> </ul>                                                                                                                                                                                                                                                                                                                       | This paragraph is applicable.                                                                                                                              |
| <b>6.3.9 Oil sight flow indicator</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                            |
| <ul style="list-style-type: none"> <li><b>6.3.9.2</b> If specified, flow indicators shall also be installed in the drain lines of totally enclosed, dry coupling guards.</li> </ul> <p><b>Note:</b> Flow indicators in dry coupling drain lines can be used to detect excessive oil leakage into the dry coupling guard.</p>                                                                                                                                                          | This paragraph is applicable. Flow indicators shall also be installed in the drain lines from cavity between tertiary seal and radial (or thrust) bearing. |
| <ul style="list-style-type: none"> <li><b>6.3.9.3</b> Unless otherwise specified, the flow indicator shall be flanged.</li> </ul>                                                                                                                                                                                                                                                                                                                                                     | This paragraph is applicable.                                                                                                                              |
| <ul style="list-style-type: none"> <li><b>6.3.9.5</b> When specified, restrictive flow indicators shall be installed in the pressurized inlet line to each continuously lubricated coupling.</li> </ul>                                                                                                                                                                                                                                                                               | This paragraph is applicable.                                                                                                                              |
| <b>6.3.10 Solenoid valves</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                            |
| <ul style="list-style-type: none"> <li><b>6.3.10.3</b> When continuously energized solenoids are specified for trip circuits, the Vendor shall provide the purchaser with the coil rating and estimated service life of each solenoid coil based on continuously energized operation. Dual-coil solenoids may be specified for any trip function. Each coil shall be capable of keeping the solenoid in its energized condition. Separate relays shall energize each coil.</li> </ul> | The Vendor shall provide the purchaser with all technical information concerning the type of solenoid valves to be used.                                   |
| <b>6.3.11 Pressure-limiting valves and pressure safety relief valves</b>                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |
| <b>6.3.11.4</b> Pressure-limiting valves and pressure                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Modification</b>                                                                                                                                        |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| safety relief valves.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Rupture disks are not allowed. Pressure safety valve shall be used in place of rupture disks.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <ul style="list-style-type: none"> <li>• <b>6.3.11.5</b> If specified, thermal relief valves shall be provided for components that can be blocked in by isolation valves.</li> </ul>                                                                                                                                                                                                                                                                                                                                              | This paragraph is applicable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>6.3.12 Control valves and regulators</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>6.4 Electrical Systems</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li>• <b>6.4.2</b> The characteristics of electrical power supplies for motors, heaters, and instrumentation will be specified.</li> </ul>                                                                                                                                                                                                                                                                                                                                                     | This paragraph is applicable, refer to Project specifications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <ul style="list-style-type: none"> <li>• <b>6.4.6</b> If specified, instrument and control wiring may be solid conductors in areas not subject to vibration.</li> </ul>                                                                                                                                                                                                                                                                                                                                                           | Rigid metallic conduits are not accepted, wiring shall be from cables and cables trays.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <ul style="list-style-type: none"> <li>• <b>6.4.11</b> Electrical materials, including insulation, shall be corrosion resistant and non-hygroscopic insofar as is possible. If specified for tropical location, materials shall be given the treatments specified as follows. <ul style="list-style-type: none"> <li>a) Parts (such as coils and windings) shall be protected from fungus attack.</li> <li>b) Unpainted surfaces shall be protected from corrosion by plating or another suitable coating.</li> </ul> </li> </ul> | <p>Electrical, control, instruments materials and installation shall be provided according to Company specifications. Request for derogation will be presented by the Vendor when necessary.</p> <p>Note a) is applicable.</p> <p>Note b) Unpainted surface shall be always 316 SS minimum grade.</p>                                                                                                                                                                                                                                                                                  |
| <ul style="list-style-type: none"> <li>• <b>6.4.13</b> Control, instrumentation, and power wiring (including temperature element leads) within the limits of the baseplate shall be installed in rigid metallic conduits, cable trays, or enclosures as specified, properly bracketed to minimize vibration and isolated or shielded to prevent interference between voltage levels.</li> </ul>                                                                                                                                   | <p>316 SS minimum grade cable trays including covers shall be used in place of conduits. Only limited portions of 316 SS minimum grade flexible type conduits are authorized when cable trays cannot be installed.</p> <p>Cable trays shall be supported with 316 SS means, including bolting and shall be equipped with soft material protections at both ends to avoid losses of seal of external cables envelops.</p> <p>Cable trays shall be properly grounded at both ends. If the cable trays are multiple segments built, continuity shall be ensured between each segment.</p> |
| <ul style="list-style-type: none"> <li>• <b>6.4.18</b> If specified, conduit drains shall be provided in all conduit low points for indoor</li> </ul>                                                                                                                                                                                                                                                                                                                                                                             | 316 SS minimum grade cable trays including covers shall be used in place of conduits. Only limited portions of 316 SS minimum grade                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

| ISO / API                                                                                                                                                                                                                                                                                                                                           | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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| installations.                                                                                                                                                                                                                                                                                                                                      | flexible type conduits are authorized when cable trays cannot be installed, however those portions shall be submitted to Company prior acceptance.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>7. Inspection, Testing and Preparation for shipment</b>                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>7.1 General</b>                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <ul style="list-style-type: none"> <li>• <b>7.1.1</b> The purchaser shall specify the extent of participation in the inspection and testing.</li> </ul>                                                                                                                                                                                             | Inspection and testing will be carried out according to Company Project QA/QC plan.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <ul style="list-style-type: none"> <li>• <b>7.1.2</b> If specified, the purchaser's representative, the Vendor's representative or both shall indicate compliance in accordance with the inspector's checklist in the applicable chapter by initialling, dating and submitting the completed checklist to the purchaser before shipment.</li> </ul> | This paragraph is applicable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <ul style="list-style-type: none"> <li>• <b>7.1.5</b> The purchaser shall specify the amount of advanced notification required for a witnessed or observed inspection.</li> </ul>                                                                                                                                                                   | Advance notification will be according to Company Project contract requirements.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>7.1.6</b> When shop inspection has been specified, the purchaser and the Vendor shall coordinate manufacturing hold points and inspectors' visits.                                                                                                                                                                                               | <p><b>Clarification, in addition</b></p> <p>When the main equipment full load and/or string test is specified, the complete lube oil system shall be mandatory used.</p> <p>The Company reserves the right to request installation of screen meshes at selected locations upstream and/or downstream filters before the beginning of full load/string test to check cleanliness of the whole system.</p> <p>In case filters differential alarm set point is activated and/or unacceptable screen mesh cleanliness, the full load/string test shall be postponed until the cleanliness of all lube oil system components have been satisfactorily demonstrated by the Vendor and accepted by the Company.</p> <p>When lube oil components cleanliness is satisfactorily achieved, the final full load and/or string test shall be carried out.</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | GS                                                                                                                                                                                         |
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| <b>7.2 Inspection</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                            |
| <b>7.2.1 General</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                            |
| <p><b>7.2.1.1</b> The Vendor shall keep the following data available for at least <b>20</b> years:</p> <ul style="list-style-type: none"> <li>a) Necessary or specified certification of materials, such as mill test reports.</li> <li>b) Test data and results to verify that the requirements of the specification have been met.</li> <li>c) Fully identified records of all heat treatment, whether performed in the normal course of manufacture or as part of a repair procedure.</li> <li>d) Results of quality control tests and inspections.</li> <li>e) Details of all repairs.</li> <li>• f) Other data specified by the purchaser or required by applicable codes and regulations.</li> <li>g) Purchase specifications for all items on bills of material.</li> <li>h) Results of documented tests and inspections, including fully identified records of all heat treatment and radiography.</li> </ul> | <ul style="list-style-type: none"> <li>f) For other data specified in the contract and/or in the Project specifications and data sheets, it shall be also kept during 20 years.</li> </ul> |
| <ul style="list-style-type: none"> <li>• <b>7.2.1.3</b> In addition to the requirements of the governing piping, pressure vessel and welding code or standard, the purchaser may specify the following: <ul style="list-style-type: none"> <li>a) That parts shall be subjected to surface and subsurface examination</li> <li>b) The type of examination required, such as magnetic particle, liquid penetrant, radiographic and ultrasonic examination.</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>Company Project QA/QC plan shall apply.</p>                                                                                                                                             |
| <b>7.2.2 Material Inspection of pressure vessels and piping systems</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                            |
| <b>7.2.2.1 General</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                            |
| <b>7.2.2.6 Positive material identification (PMI)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                            |
| <ul style="list-style-type: none"> <li>• <b>7.2.2.6.1</b> If specified, the following alloy items shall be subject to PMI testing: <ul style="list-style-type: none"> <li>a) Overhead seal tank</li> <li>b) Rundown oil tank.</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p>This paragraph is applicable.</p>                                                                                                                                                       |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                       | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
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| <ul style="list-style-type: none"> <li>• <b>7.2.2.6.2</b> In addition to the components outlined in 7.2.2.6.1, other materials, welds, fabrications and piping shall be PMI tested as specified and fully defined, including any sampling requirements.</li> </ul>                                                                                                                                                                              | This paragraph is applicable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <p><b>Addition</b></p> <p>When radiographic, ultrasonic, magnetic particle or liquid penetrant inspection of welds or materials is required or specified, the criteria in 7.2.2.2 through 7.2.2.5 shall apply unless other criteria are specified by the Purchaser. Cast iron may be inspected in accordance with 7.2.2.4 and 7.2.2.5. Welds, cast steel, and wrought material may be inspected in accordance with 7.2.2.2 through 7.2.2.5.</p> | <p>Following non destructive tests on welds:</p> <ul style="list-style-type: none"> <li>• Radiographic or ultrasonic examinations and</li> <li>• Magnetic particle, or liquid penetrant examinations</li> </ul> <p>shall be performed.</p> <p>Following non destructive tests on cast iron, steel and wrought: radiographic, ultrasonic, magnetic particle, or liquid penetrant inspections shall be performed.</p> <p>Acceptance criteria shall be as per paragraphs 7.2.2.2 through 7.2.2.5.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>7.2.3 Mechanical Inspection</b>                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <p><b>7.2.3.1</b> During assembly of the system and before testing, each component and all piping and appurtenances shall be inspected to ensure they have been cleaned and are free of foreign materials, corrosion products and millscale.</p>                                                                                                                                                                                                | <p><b>Clarification &amp; Addition</b></p> <p>Vendor shall specify the piping cleanliness level required with the corresponding standard. The oil piping shall be designed and routed in such way that all piping can be dismantled or broken on site, to be cleaned separately or by group of assembled sections. The cleaning method shall be passivation followed by neutralization, drying and preservation, handled by specialized qualified Sub-Vendor.</p> <p>For onsite final flushing, all bearings inlet and outlet piping sections shall be provided with Te, engineered prefabricated and removable bypasses, with spades located at inlet and outlet of bearing housing, supplied as special tools to minimize piping disassembly.</p> <p>Vendor shall provide the dedicated study and detailed drawings covering the piping design, the cleaning and the final flushing procedures to be approved by Company; but when required the Company reserves the right to ask for Company's flushing procedure application</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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| <ul style="list-style-type: none"> <li>• <b>7.2.3.2</b> If specified, the purchaser may inspect the equipment and all piping and appurtenances for cleanliness before heads are welded onto vessels, openings in vessels or exchangers are closed or piping is finally assembled.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>Lube oil components cleanliness is a “holding” point. Inspection will be carried out according to Vendor project QA/QC plan. Advance notification will be according to Company Project contract requirements.</p> <p>The lube oil system flushing before the string test execution shall be performed with flexible hoses and adapters dedicated to the job and supplied by the Vendor.</p>                                                                                                                                                                                                                                                                                                                      |
| <ul style="list-style-type: none"> <li>• <b>7.2.3.3</b> If specified, the hardness of parts, welds and heat-affected zones shall be verified as being within the allowable values by testing. The method, extent, documentation and witnessing of the testing shall be mutually agreed upon by the purchaser and the Vendor.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p>To be mutually agreed between Company and Vendor and included in the Vendor Inspect and test plan.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>7.3 Testing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>7.3.2 Hydrostatic test</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <p><b>7.3.2.1</b> Pressure-containing parts (including auxiliaries) shall be tested hydrostatically with liquid at a minimum of 1.5 times the maximum allowable working pressure (MAWP) unless limited by the hydrotest pressure of a component in the system that has been hydrotested to 1.3 times its MAWP. In this case, hydrotest shall be a minimum of 1.3 times the MAWP. Minimum hydrotest pressure shall not be less than 150 kPa (1.5 bar; 20 psi). The test liquid shall be at a higher temperature than the nil-ductility transition temperature of the material being tested. See ASTM E 1003.</p> <p><b>Note 1:</b> The nil-ductility temperature is the highest temperature at which a material experiences complete brittle fracture without appreciable plastic deformation.</p> <p><b>Note 2:</b> The ASME pressure vessel code and other pressure vessel codes allow hydrotesting to 1.3 times MAWP.</p> | <p><b>Clarification &amp; Addition</b></p> <p>System shall be design in such way that all components shall support the hydrotest at 1.5 times the MAWP.</p> <p><b>ASTM E 1003</b> significance and use is restricted use of the sole hydrotest when toxic or explosive gas is expected, consequently and prior shipment after full component assembly, the Vendor shall performed a leak test at the MAWP under N2+He as tracer gas for leak detection.</p> <p>Whatever the method of testing, Vendor has to provide in the hydrotest and leak test report the full traceability of the tests by producing the test chart records showing as minimum, pressure, time, temperature pressure ramp-up and release.</p> |
| <b>7.4 Preparation for shipment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <p><b>7.4.3</b> The equipment shall be prepared for shipment after all testing and inspection have</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p><b>Clarification &amp; Addition</b></p> <p>Prior shipment and after testing, any tested</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | GS                                                                                                                                                                                                                                                                |
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| <p>been completed and the equipment has been released by the purchaser. The preparation shall include that specified as follows.</p> <p>a) Except for machined surfaces, all exterior surfaces that can corrode during shipment, storage or in service shall be given at least one coat of the manufacturer's standard paint. The paint shall not contain lead or chromates.</p> <p><b>Note:</b> Austenitic stainless steels are typically not painted.</p> <p>b) Exterior machined surfaces except for corrosion-resistant material shall be coated with a suitable rust preventive.</p> <p>c) The interior of the equipment shall be clean; free from scale, welding spatter and foreign objects; and sprayed or flushed with a rust preventive that can be removed with solvent.</p> <p>d) Internal surfaces of bearing housings and carbon steel oil systems' components shall be coated with an oil soluble rust preventive that is compatible with the lubricating oil.</p> <p>e) Flanged openings shall be provided with metal closures at least 5 mm (3/16 in) thick with elastomer gaskets and at least four full-diameter bolts. For studded openings, all nuts required for the intended service shall be used to secure closures. Each opening shall be car sealed so that the protective cover cannot be removed without the seal being broken.</p> <p>f) Threaded openings shall be provided with steel caps or round-head steel plugs in accordance with ANSI/ASME B16.11. The caps or plugs shall be of material equal to or better than that of the pressure casing. In no case shall non-metallic (such as plastic) caps or plugs be used.</p> <p>g) Openings that have been bevelled for welding shall be provided with closures designed to prevent entrance of foreign material and damage to the bevel.</p> <p>h) Lifting points and lifting lugs shall be clearly identified on the equipment package. The recommended lifting arrangement shall be as</p> | <p>equipment component and auxiliary shall not be disassembled and/or removed from single lifting assembly design for packing purpose. The design of any equipment, component and auxiliary shall take account of packing and fastening at engineering stage.</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | GS                                                                                                                                                         |
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| <p>described in the installation manual.</p> <p>i) The equipment shall be identified with securely affixed, corrosion-resistant metal tags indicating the item and serial number of the equipment for which it is intended. In addition, crated equipment shall be shipped with duplicate packing lists, one inside and one on the outside of the shipping container.</p> <p>j) The base and all components and piping of a package or an assembled oil system or dry gas seal module shall be shipped as a single assembly and shall be temporarily braced as necessary to prevent damage during shipment. To minimize the entrance of contaminants, no component shall be disassembled for shipment except as required for protection against vibration or other damage during handling and shipment.</p> <p>k) Pumps and drivers shall be uncoupled and exposed shafts and shaft couplings shall be wrapped with waterproof, mouldable waxed cloth or volatile corrosion inhibitor paper. The seams shall be sealed with oil proof adhesive tape.</p> <p>l) Each filter shall be shipped with clean elements installed and shall carry outside a securely affixed all-weather tag stating "SHIPPED WITH CLEAN ELEMENTS INSTALLED".</p> |                                                                                                                                                            |
| <ul style="list-style-type: none"> <li>• <b>7.4.7</b> If specified, one copy of the Manufacturers standard installation instructions shall be packed and shipped with the equipment.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>Manufacturer installation instruction shall be part of the commissioning manual.</p>                                                                    |
| <b>8. Vendor's data</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                            |
| <b>8.2 Proposals</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                            |
| <b>8.2.3 Technical data</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                            |
| <ul style="list-style-type: none"> <li>• <b>8.2.3.2</b> If specified by the purchaser, procurement of components shall not proceed without the purchaser's review and acceptance of the components selected. If specified by the purchaser, the manufacture of the console shall not proceed without the</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>Manufacturer can proceed without purchaser's formal approval. However Vendor shall submit the layout of components and piping for purchaser review.</p> |

| ISO / API                                                                                                                                                                                                                                                                              | GS                                                            |
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| purchaser's review of the layout of components and piping.                                                                                                                                                                                                                             |                                                               |
| <b>8.3.3 Technical data</b>                                                                                                                                                                                                                                                            |                                                               |
| <ul style="list-style-type: none"> <li><b>8.3.3.1</b> When specified, the Vendor shall submit certified copies of the test data to the Purchaser prior to shipment.</li> </ul>                                                                                                         | This paragraph is applicable.                                 |
| <ul style="list-style-type: none"> <li><b>8.3.3.2</b> If specified, the Vendor shall submit certified copies of the test data to the purchaser before shipment.</li> </ul>                                                                                                             | This paragraph is applicable.                                 |
| <ul style="list-style-type: none"> <li><b>8.3.4</b> Progress reports. If specified, the Vendor shall submit progress reports to the purchaser at the intervals specified.<br/><b>Note:</b> Refer to the description of item m) in Annex C for the content of these reports.</li> </ul> | This paragraph is applicable, refer to project specification. |
| <b>8.3.6 Installation, operation, maintenance and technical data manuals</b>                                                                                                                                                                                                           |                                                               |
| <b>8.3.6.1 General</b>                                                                                                                                                                                                                                                                 |                                                               |
| <ul style="list-style-type: none"> <li><b>8.3.6.4 Technical data manual</b><br/>If specified, the Vendor shall provide the purchaser with a technical data manual within 30 days of completion of shop testing.</li> </ul>                                                             | This paragraph is applicable.                                 |

## Annex D (informative)

### Oil or gas filter performance and oil-system cleanliness testing

| API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | GS                                                                                                                                                                                                                                                                                                                                                                      |
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| <p><b>D.2.6 Dry gas seal filtration</b></p> <p>On most dry gas seal systems, there are two sets of gas filters; one for the separation gas and one for the seal gas. The separation gas is generally an inert, dry gas, such as nitrogen. Unless there are special circumstances identified to the Vendor, the filters for separation gas do not require coalescing capability.</p> <p>if the seal gas has a dew point too close to operating temperature (including any Joules Thompson effect at the: control valve) downstream of the controlling device, a seal gas filter/separator should be supplied with elements that are a combined filter/coalescer or with two separate elements, one for filtering and one for coalescing (see ISO 10438-4:2007, 4.2.7).</p> | <p><b>Clarification</b></p> <p>Separation gas is requiring installation of duplex filter type without coalescing element whatever fluid Nitrogen or Air instrument.</p> <p>Seal gas filter shall be of combined duplex filter/coalescer type.</p> <p>Air Instrument supply shall be provided with duplex filters, filtration of 3 micron size replaceable elements.</p> |

#### 4. Comments to **ISO 10438-2/API Std 614**

##### Part 2 - Special-purpose oil systems

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | GS                                                                                                                                                                                                                                                          |
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| <b>1. Scope</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                             |
| <p>This part of ISO 10438, in conjunction with of ISO 10438-1, specifies requirements for oil systems for special-purpose applications. These oil systems can provide lubrication oil, seal oil or both. These systems can serve equipment such as compressors, gears, pumps and drivers.</p> <p><b>Note:</b> The term "special-purpose application" is defined in ISO 10438-1.</p>                                                                                                         | <p>Special purpose oil system shall be used for:</p> <ul style="list-style-type: none"> <li>• Power generation units</li> <li>• Compressor trains units</li> <li>• Pumping system units</li> </ul> <p>with the inclusion of drivers and gears (if any).</p> |
| <b>4. General requirements</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                             |
| <ul style="list-style-type: none"> <li>• <b>4.1.4</b> The purchaser shall specify the equipment's normal operating point and alternate operating points including transients.</li> </ul>                                                                                                                                                                                                                                                                                                    | <p>Refer to the equipment data sheet.</p>                                                                                                                                                                                                                   |
| <ul style="list-style-type: none"> <li>• <b>4.1.5</b> Control of the sound pressure level (SPL) of all equipment furnished shall be a joint effort of the purchaser and the Vendor having unit responsibility. The equipment furnished by the Vendor shall conform to the maximum allowable sound pressure level specified. In order to determine compliance, the Vendor shall provide both maximum sound pressure and sound power level data per octave band for the equipment.</li> </ul> | <p>Oil systems shall be considered as part of the main rotating equipment supply and, as such shall comply with the contractual specified noise requirements of the package.</p>                                                                            |
| <ul style="list-style-type: none"> <li>• <b>4.1.6</b> The purchaser shall specify whether the seal-oil and lube-oil systems are to be separate or combined.</li> </ul> <p><b>Note:</b> Annex B contains piping and instrument diagrams (P&amp;IDs) for typical arrangements.</p>                                                                                                                                                                                                            | <p>Seal-oil and lube-oil systems shall be separate.</p>                                                                                                                                                                                                     |
| <ul style="list-style-type: none"> <li>• <b>4.1.7</b> Where oil is supplied from a common system to two or more machines (such as a compressor, a gear and a motor), the oil's characteristics shall be specified by the Owner on the basis of mutual agreement with all Vendors supplying equipment served by the common oil system.</li> </ul> <p><b>Note:</b> Site conditions with extreme variations,</p>                                                                               | <p>Whenever possible, Total brand lubricating oils shall be used. Vendor shall clearly indicate in the proposal the type of lubrication oil to be used.</p>                                                                                                 |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                       | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| such as desert or arctic applications, can also require special oil grade viscosity and increased oil supply temperatures.                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <ul style="list-style-type: none"> <li>• <b>4.1.8</b> The system shall be designed to supply oil to all equipment specified.</li> </ul>                                                                                                                                                                                                                                                                                                         | Vendor assuming full responsibility of the complete shaft line shall check the oil characteristics for the combined oil system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <ul style="list-style-type: none"> <li>• <b>4.1.10</b> The seal-oil system shall be designed to serve the full range of equipment operating conditions specified. These conditions may include but are not limited to the following: <ul style="list-style-type: none"> <li>a. Settling-out pressures</li> <li>b. Process relief valve settings</li> <li>c. Shop test and field run-ins</li> <li>d. Start-up conditions.</li> </ul> </li> </ul> | This paragraph is applicable, case selection shall be the worst condition.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <p><b>4.1.12</b> The arrangement of the equipment, including piping and auxiliaries, shall be developed jointly by the purchaser and the Vendor. The arrangement shall provide adequate clearances areas and safe access for operation and maintenance.</p>                                                                                                                                                                                     | <p><b>Clarification &amp; Addition</b></p> <p>A maintenance review shall be organized between the Vendor and the Company. This review shall take place before the manufacturing of the Lube Oil System, Seal, Gas Panel and interconnecting piping internal to the package.</p> <p>This review shall be based on CAD 3D models (if available, otherwise 2D models will be used).</p> <p>As a minimum, the following shall be reviewed but not limited to:</p> <ul style="list-style-type: none"> <li>• Access to LOS manual valves</li> <li>• Access to LOS filters</li> <li>• Access to manhole</li> <li>• Gauges and digital display location for ease of reading.</li> </ul> <p>Access to main components for dismantling (LO pumps, filters cartridges, LO coolers plates -if any-).</p> <p>The Company reserves the right to ask for layout modification if state of the art for ease of maintenance and accessibility are not met.</p> <p>The date of this meeting shall be mutually agreed between Vendor and Company during the KOM.</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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| <ul style="list-style-type: none"> <li>• <b>4.1.13</b> If applicable, the purchaser shall specify minimum requirements for clearance around and access to components (especially clearance around and access to coolers, filters and hand valves).</li> </ul>                                                                                                                                                                                                                                                                                                               | <p>Clearance around equipments shall be designed in such a way that all permanent access shall be provided for operation and maintenance of the machineries.</p> <p>Any pieces of equipment, any electrical material or instrument shall be accessible from skid edge or from gangways with grating adequately located within the confines of the unit.</p> <p>This shall comply with the environment data requirement defined in Project specifications.</p> |
| <p><b>4.1.15</b> Valved vents, drains and piping shall be furnished to permit draining, cleaning and refilling of idle components while the equipment is in operation.</p>                                                                                                                                                                                                                                                                                                                                                                                                  | <p><b>Clarification &amp; Addition</b></p> <p>An accessible and dedicated lube oil sampling point shall be provided. The sampling point shall be located upstream lube oil filtration.</p>                                                                                                                                                                                                                                                                    |
| <ul style="list-style-type: none"> <li>• <b>4.1.16</b> The purchaser shall specify when and where double block and bleed valves are required for isolating a component and how they are arranged.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                | <p>Instruments, filters, coolers shall be provided with block, bleed and vent valves, however the double block and bleed valve shall always be provided for high pressure and sour gas services. Company shall have the right to request additional double block and bleed where necessary.</p>                                                                                                                                                               |
| <ul style="list-style-type: none"> <li>• <b>4.1.17</b> Coolers, filters, overhead oil tanks, drain traps, accumulators and other pressure vessels shall be in accordance with the specified pressure design code (Refer to ISO 10438-1:2007, 4.4). If specified by the purchaser, vessels shall be code stamped.</li> </ul> <p><b>Note 1:</b> Code stamping might not be applicable for pressure design codes other than ASME.</p> <p><b>Note 2:</b> Refer to ISO 10438-1:2007, 4.5.7. Local jurisdictions can require a code stamp and conformity assessment markings.</p> | <p>ASME code Section VIII is applicable.</p>                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <ul style="list-style-type: none"> <li>• <b>4.1.19</b> The Vendor shall advise the purchaser of, and both parties shall mutually agree upon, any special provisions that are necessary to ensure that an adequate supply of backup lube or seal oil or both is maintained in the event of complete failure of the primary lube- or seal-oil supply system. These provisions may include: emergency</li> </ul>                                                                                                                                                               | <p>In addition, any emergency pumps required to protect the unit shall be fed from DC power supply. In such case, the complete system such as but not limited to the distribution panels, the motor starters, the junction boxes, the cables shall be designed and certified for zone 1.</p>                                                                                                                                                                  |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                           | GS                                                                                                                     |
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| pumps, accumulators, rundown tanks and special arrangements for equipment safety and protection when the equipment decelerates. Provisions shall be adequate for coast-down time, cool-off time and block-in time as applicable; the purchaser shall specify the required block-in time. The purchaser and the Vendor shall mutually agree upon the system and its components.                                                                      |                                                                                                                        |
| <b>4.2 Baseplates</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                        |
| <ul style="list-style-type: none"> <li>• <b>4.2.1</b> The system shall be designed as a single console, in multiple packages or in any other arrangement as specified. Each package shall have a structural steel baseplate with all system components and related valves and manifolds mounted on the baseplate. The major component supports (pumps, filters, coolers, reservoir, etc.) shall be mounted directly on structural steel.</li> </ul> | This paragraph is applicable, however the Lube Oil System shall be fully integrated on the main equipments base plate. |
| <ul style="list-style-type: none"> <li>• <b>4.2.3</b> If specified, flat decking may be furnished.</li> </ul> <p><b>Note:</b> Minor puddling of fluid can occur.</p>                                                                                                                                                                                                                                                                                | Flat decking on the base plate is not admitted, design shall be in such way that pudding of fluid shall not occur.     |
| <ul style="list-style-type: none"> <li>• <b>4.2.7</b> When epoxy grout is specified, the Vendor shall pre-coat all the grouting surfaces of the mounting plates with a catalyzed epoxy primer applied to degreased white metal. The epoxy primer shall be compatible with epoxy grout. The Vendor shall submit instructions for field preparation of the epoxy primer to the purchaser.</li> </ul>                                                  | This paragraph is applicable when epoxy grout is used.                                                                 |
| <ul style="list-style-type: none"> <li>• <b>4.2.9</b> If specified, the baseplate shall be designed for column mounting (that is, of sufficient rigidity to be supported at specified points) without continuous grouting under structural members. The baseplate design shall be mutually agreed upon between the purchaser and the Vendor.</li> </ul>                                                                                             | This paragraph is applicable. The base plate design is the sole responsibility of the Vendor.                          |
| <b>4.3 Oil Reservoirs</b>                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                        |
| <b>4.3.2 Protection From Dirt and Water</b>                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                        |
| <b>4.3.2.2</b> Unless otherwise approved, pumps, coolers or filters shall not be mounted on top                                                                                                                                                                                                                                                                                                                                                     | Equipment may be mounted on top of the reservoir whatever installation, onshore or                                     |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| of the reservoir.<br><b>Note:</b> It is possible that this can be a user consideration for offshore or other installations where available space is limited.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | offshore.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>4.3.4 Manways and Drains</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| To ensure complete drainage, the bottom of each reservoir shall slope continuously, at least 1:50 (1/4 in/ft), to a low point. A flanged drain connection (with a valve and a blind flange) at least 50 mm (2 in) in size shall be provided. Manway openings shall be provided which will permit unobstructed entry for inspection and cleaning of all interior compartments. If entry is required for cleaning and unless otherwise specified, manways shall be located on top of the reservoir and each manway shall be at least 60 cm x 60 cm or 45 cm in diameter (24 in x 24 in or 18 in, in diameter). Internal manways are not acceptable.                                                                                                                                                                                                                                      | The drain tube shall be routed to the limit of the skid. The flange shall be located outside the skid edge.<br><br>In addition, oil reservoirs shall be provided with two flanged connections with valves and blind flanges for connecting to an oil conditioner unit.                                                                                                                                                                                                                                                                                |
| <b>4.3.5 Features and Appendages</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>4.3.5.1</b> The oil reservoir shall have the following features and appendages:<br>a) Capacity to settle moisture and foreign matter adequately and to provide allowance for rundown from the entire system.<br>b) Provisions to eliminate air and minimize migration of foreign matter to each pump suction.<br><br>c) A reflex-type, welding-pad oil level glass (with stainless steel weld pad and carbon steel cover) arranged to cover the span from at least 25 mm (1 in) above the rundown level to 50 mm (2 in) below the pump suction loss level. The oil level glass shall be located as far away as possible from the oil return lines and be visible from the perimeter of the unit (see 4.3.3.1). The maximum and minimum operating levels, rundown level and suction-loss level shall be indicated on the level glass. If more than one level glass is provided, they | In addition, the reservoir shall be provided with:<br><ul style="list-style-type: none"> <li>• A local temperature gauge</li> <li>• A vent mist eliminator, (fan extractor shall be accepted as long as a backup is included).</li> </ul> The Vendor shall clearly indicate in its proposal the residual reject of lube oil in the atmosphere.<br><br>c) This paragraph is not applicable when the Lube Oil System is enclosed in the main equipments baseplate only level gauges and level transmitters shall be used as per project specifications. |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | GS                                   |
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| <p>shall be offset.</p> <p>d) Unless otherwise specified, a fill opening at least 50 mm (2 in) in diameter, which automatically closes (normally held shut by a spring) and is equipped with a stainless steel fine-mesh strainer basket that has an open area equal to 200% of the internal pipe area.</p> <p><b>Note:</b> Some users pipe up fill connections using the connections provided in 4.3.9. If manual fill is used, the connection described above is required.</p> <p>e) Blind-flanged vent connection at least 50 mm (2 in) in diameter.</p> <p>f) For lube-oil reservoirs, a weatherproof, corrosion-resistant filter-breather cap at least 50 mm (2 in) in diameter with filtration rating of 10 <math>\mu</math>m beta 10 or better. (For reservoirs containing seal oil, see 4.3.5.2).</p> <p>g) Internal baffles that do not trap gas.</p> <ul style="list-style-type: none"> <li>h) If the driver of the train is lubricated by the same system as the compressor and the oil reservoir contains the seal oil, a separate connection shall be provided on the reservoir for the compressor seal-oil return line.</li> </ul> <p><b>Note 1:</b> This line prevents pressurization of the drivers lube-oil drain header if the compressor seals fail.</p> <p><b>Note 2:</b> If this option is incorporated, it requires separate bearing and seal-oil drains from the compressor.</p> | <p>h) This clause is applicable.</p> |
| <b>4.3.7 Heating</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                      |
| <b>4.3.7.2</b> Purchaser shall specify whether the heaters are steam or electric.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Heaters shall be electric powered.   |
| <b>4.3.7.7</b> If specified, the Vendor having train responsibility shall conduct an analysis of the complete system, including lube-oil console, interconnecting piping, rundown tanks, equipment heat loss and other system components, to verify that the complete system heats up to the minimum equipment starting temperature in 12 h when ambient temperature is at the minimum specified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | This paragraph is applicable.        |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                              | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
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| value.                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>4.3.8 Provision for insulation</b>                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| If specified by the purchaser, reservoirs shall be fitted with insulation clips. The purchaser shall furnish and install the insulation.                                                                                                                                                                                                                                               | <b>Clarification</b><br>When insulation and heat tracing are required by Project specifications or by extreme weather conditions, they shall be provided and shall be installed by the Vendor before shipment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>4.3.10 Provision for oil conditioner</b>                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>4.3.10.1</b> If specified, the Vendor shall provide a 25 mm (1 in) flanged, valved and blinded connection (see Figure B.24, Footnote i), located below the minimum operating level for use as an oil supply connection for an oil conditioner.                                                                                                                                      | This paragraph is applicable; reservoir shall be always design as figure B.24 with additional requirement herewith specified (High & Low oil level specific functions).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>4.3.12 Special Features</b>                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>4.3.12.1</b> Reservoir tops shall be provided with the following: <ul style="list-style-type: none"> <li>• If specified, an accessible ladder with extended handrails</li> <li>• If specified, handrails around the perimeter of the reservoir top</li> <li>• If specified, non-skid surfaces decking (checker or diamond plate or hot-dipped galvanized steel grating).</li> </ul> | <p>This paragraph is applicable when final base plate installation is located at more than 0.30 m above ground or deck level in the following conditions:</p> <p>Base plate level above 0.30 m and up to 1.5 m access stairs and necessary handrails shall be provided for stairs and baseplate where necessary.</p> <p>Base plate level above 1.50 m access ladders including safety cage and necessary handrails shall be provided for baseplate where necessary.</p> <p>Non skid surfaces decking shall be provided, hot dip galvanized steel grating or fire resistant polyester fibre grating is preferable. However when checker or diamond plates are provided, they shall be painted with anti-slippage coating.</p> |
| <b>4.3.13 Materials</b>                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Materials</b><br>Unless otherwise specified, reservoirs and all appendages welded to reservoirs shall be fabricated from austenitic stainless steel in accordance with ASTM A 240/A 240M. Pipe                                                                                                                                                                                      | Reservoirs and all appendages to reservoirs shall be fabricated from AISI 316L SS as a minimum material grade. When drop in design reservoir cannot be supplied, the reservoir shall be fully 316L SS clad including all welded appendages. All 316L SS appendages                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | GS                                                                                                                                                                                                                                                                                                                                                                    |
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| connections shall be as specified in 5.1.<br><b>Note:</b> Carbon steel appendages, such as ladders and handrails, can be bolted to clips welded to the reservoir.                                                                                                                                                                                                                                                                                                                                                                                                   | welded to the reservoir shall be painted with the same painting system selected for reservoir.<br><b>Clarification</b><br>For reservoir located within-skid, only drop-in designs shall be accepted.                                                                                                                                                                  |
| <b>4.3.14 Grounding</b><br>Two grounding clips or pads diagonally opposed to each other (see Figure B.24) shall be welded to the reservoir.<br>The pads shall accommodate a 13 mm (1/2 in UNC) bolt.                                                                                                                                                                                                                                                                                                                                                                | <b>Clarification</b><br>Only 316L SS two diagonally grounding pads fully welded on reservoir and on baseplate shall be provided.<br>The pads shall accommodate 13 mm metric bolts.                                                                                                                                                                                    |
| <b>4.4 Pumps and Drivers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                       |
| <ul style="list-style-type: none"> <li><b>4.4.1</b> The oil system shall include a main oil pump and a standby oil pump both suitable for continuous operation. For non shaft-driven pumps, the main and standby pumps shall be identical. The purchaser shall specify whether horizontal centrifugal or rotary pumps shall be used. Except as modified in this part of ISO 10438, pumps shall conform to ISO 13709.</li> </ul> <b>Note:</b> For the purpose of this provision, API Std 610 is equivalent to ISO 13709.                                             | <p>This paragraph is applicable.</p> <p>However main oil pump and standby oil pump can only be centrifugal as per <a href="#">ISO 13709</a>, <a href="#">ISO 5199</a> or <a href="#">API Std 675</a> screw types.</p>                                                                                                                                                 |
| <ul style="list-style-type: none"> <li><b>4.4.3</b> If specified by the purchaser, an emergency oil pump shall be furnished to allow safe shutdown without damage to the equipment in the event that both the main and standby pumps fail. The purchaser and driven equipment Suppliers shall define the requirements for safe shutdown.</li> </ul> <b>Note:</b> A lube-oil rundown tank can provide bearing oil for rundown. Some times an emergency oil pump with separate power source is supplied in order to allow cool-down oil after coast-down or seal oil. | <p>This paragraph is applicable but safe shutdown of equipment remains the sole responsibility of Vendor. However if separate source is supplied, it shall DC source system ATEX certified for use in hazardous area. The Vendor shall provide the complete DC source system including batteries, chargers, starters and internal connections between subsystems.</p> |
| <b>4.4.4</b> Unless otherwise specified, oil pumps not submerged inside the reservoir shall be equipped with mechanical seals that have carbon rings with mating tungsten or silicon carbide rings; Buna or Viton gaskets 2) and O-rings; and end plates with throttle bushings as                                                                                                                                                                                                                                                                                  | Vendor standard shall be clearly indicated in his proposal.                                                                                                                                                                                                                                                                                                           |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | GS                                                                                                                                                                                                                                           |
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| outlined in ISO 13709.<br><b>Note:</b> For the purpose of this provision, API Std 610 is equivalent to ISO 13709.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                              |
| <ul style="list-style-type: none"> <li><b>4.4.5</b> Purchaser shall specify if the main oil pump shall be turbine or motor driven. Standby pumps shall be motor driven.</li> </ul> <b>Note 1:</b> Standby pumps are motor driven due to relatively long start-up times for turbine driven pumps.<br><b>Note 2:</b> Typically, installations for two motor driven pumps have electric feeds from independent sources.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | This paragraph is applicable. The main oil pump shall be shaft or electrically driven.                                                                                                                                                       |
| <b>4.4.13</b> Pump drivers shall be sized according to whichever of the following requires the larger driver: <ul style="list-style-type: none"> <li>Applicable pump standard; or</li> <li>Conditions given in 4.4.13 a) and 4.4.13 b).</li> </ul> Motor drivers for centrifugal pumps shall have a power rating which covers the end-of-curve requirements of the supplied impeller with a minimum nameplate rating of 1.0 kW for kW-rated motors or 1.0 hp for horsepower rated motors.<br>a) Centrifugal pumps shall deliver the specified system pressure over the pump's stable flow range when the temperature of the pumped oil is 10°C (50°F).<br>b) Rotary pumps shall be capable of operating at the specified pump pressure limiting valve setting (including accumulation) when the temperature of the pumped oil is 10°C (50°F). <ul style="list-style-type: none"> <li>c) Purchaser shall specify the minimum inlet steam temperature and pressure and the highest exhaust pressure under which the turbine is expected to operate.</li> </ul> | <b>Modification</b><br>Motor drivers: This paragraph is modified as follow for electrical motor rating.<br>Driver shall be sized and rated in accordance with <b>GS EP MEC 101</b> .<br><br>c) Refer to Project data sheets when applicable. |
| <b>4.4.27</b> Each coupling shall have a coupling guard which is removable without disturbing the coupled elements and shall meet the requirements of a) through c).<br>a) Coupling guards shall enclose the coupling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                              |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| <p>and the shafts to prevent personnel from contacting moving parts during operation of the equipment train. Allowable access dimensions shall comply with specified standards, such as ISO 14120 or ASME B15.1.</p> <p>b) Guards shall be constructed with sufficient rigidity to withstand a 900 N (200 lbf) static point load in any direction without the guard contacting moving parts.</p> <ul style="list-style-type: none"> <li>c) Guards shall be fabricated from solid sheet or plate with no openings. Guards fabricated from expanded metal or perforated sheets may be used if the size of the openings does not exceed 10 mm (0.375 in).</li> </ul> <p>Guards shall be constructed of steel, brass or non-metallic (polymer) materials. Guards of woven wire shall not be used. If specified, non-sparking guards of agreed material shall be supplied.</p> | <p>c) Perforated sheets are not admitted, for coupling guards of the main equipments as driver, gear, driven equipment's which shall always be fully enclosed type with necessary provision for drain and vent when necessary. Coupling guard drain lines shall be equipped with Flow Glass indicator.</p> <p>For auxiliaries, fully enclosed coupling guards are not requested, however it shall be non-metallic.</p> <p>The coupling guard material shall be non-sparking type.</p> |
| <b>4.5 Coolers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>4.5.1 General</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <ul style="list-style-type: none"> <li><b>4.5.1.3</b> If specified, multi-plate frame or air coolers in accordance with 4.5.3 or 4.5.4, respectively, shall be supplied. The Vendor shall include in the proposal complete details of any proposed air-cooled or plate-frame cooler.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>This paragraph is applicable, multi-plate frame duplex cooler shall be selected, however single frame air cooler is acceptable and it shall be 2 x 100% or 3 x 50% fan design. Refer to equipment data sheets.</p>                                                                                                                                                                                                                                                                 |
| <ul style="list-style-type: none"> <li><b>4.5.1.4</b> If specified, the Vendor shall supply connections for installation of the purchaser's air-cooled oil cooler(s) off the oil console.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>This paragraph is applicable.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <ul style="list-style-type: none"> <li><b>4.5.1.6</b> If specified, in lieu of the requirements of <b>4.5.1.5</b>, for duplex cooler arrangements, the Vendor shall provide thermal over-pressure protection of the oil side of the coolers by providing separate thermal relief valves on each cooler.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p>This paragraph is applicable.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <p><b>4.5.1.11</b> Each cooler shall be sized to accommodate the total cooling load.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p><b>Clarification</b><br/>Each cooler shall be sized to accommodate</p>                                                                                                                                                                                                                                                                                                                                                                                                             |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>120% of the total cooling load. In case of air coolers, fans and motors shall be sized accordingly.</p> <p>A cooling air system must comply with <a href="#">API Std 661</a> standard. Each cooler shall be sized for 120% of thermal load at maximum ambient temperature. If air coolers are used, the rated thermal duty must be met with one fan off.</p> <p>All fans, shafts, coupling and other moving parts of mechanical equipment shall be supplied with non sparking protective guards.</p> <p>All lubrication fittings shall be extended to points outside of guards easily accessible allowing servicing during operation without removing guards.</p> <p>Each fan shall be provided with a vibration shutdown switch of manual reset type, interfaced with unit control panel.</p> |
| <p><b>4.5.1.13</b> Unless otherwise specified, an oil bypass line around the cooler with a temperature-control valve shall be included to regulate the oil-supply temperature. This includes oil systems where the purchaser supplies the cooler. In no case, however, shall oil bypass the filter. The control valve shall be in accordance with the following provisions a) to d).</p> <p><b>Note:</b> When fouling or freezing of the water side of a cooler is a factor and oil temperature is regulated by adjusting waterflow through the cooler, it is possible for the cooler water side to silt up or freeze and break at low water flow rates.</p> <p>a) Unless otherwise specified, the oil bypass valve shall be a flanged and pneumatically operated (air-to-open fail-close), two-port or three-port temperature-control valve. Failure of the control valve shall cause all the oil to pass through the cooler.</p> <p><b>Note:</b> Three-port valves can direct the oil more advantageously due to system pressure drops and allow all of the oil to bypass the cooler; however, they can complicate bypass</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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| <p>arrangements required for maintenance relative to those of a two-port valve.</p> <p>b) If specified, the temperature-control valve shall be an internal, thermostat-operated three-port valve.</p> <ul style="list-style-type: none"> <li>c) The temperature-control valve shall be provided with a manual override that permits operation independent of temperature conditions.</li> <li>d) The temperature-control valve and piping shall be sized to handle all oil flow passing through the cooler. For a three-way temperature control valve, the pressure drop should not exceed that through the cooler. For a two-way temperature control valve, pressure drop should not exceed 50% of the pressure drop through the cooler.</li> </ul> | <p>c) This clause is applicable.</p>                                                                |
| <ul style="list-style-type: none"> <li>4.5.1.15 If specified, shell-and-tube or plate-frame coolers shall be suitable for use of a 150°C (300°F) heating medium. Steam may be used for auxiliary heating on start-up by sparging it into the cooling water. Steam should not be introduced directly into the cooler.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>Coolers shall not use heating medium such as steam or a mixture of steam and water.</p>          |
| <ul style="list-style-type: none"> <li>4.5.1.17 If specified, the coolers shall be fabricated with flanged vent and drain nozzles. Screwed and seal welded or socket-welded pipe and flange additions to coolers after cooler certification are not acceptable.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>This paragraph is applicable.</p>                                                                |
| <ul style="list-style-type: none"> <li>4.5.1.18 If specified, cooler oil drains shall be manifolded together with filter clean-side oil drains.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>Cooler oil drains shall be manifolded with filter clean side oil only when easily practical.</p> |
| <ul style="list-style-type: none"> <li>4.5.1.19 If specified, vents on the oil side shall be piped back to the reservoir through flow indicators.</li> </ul> <p><b>Note:</b> These vent lines are normally tubed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>This paragraph is applicable. Tubed vents are not acceptable and shall be piped vents.</p>       |
| <b>4.5.2 Shell-and-tube coolers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                     |
| <ul style="list-style-type: none"> <li>4.5.2.6 U-bend tubes are permitted when approved by the purchaser.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>This clause is applicable.</p>                                                                   |
| <p><b>4.5.2.7</b> Unless otherwise specified, cooler shells, channels and covers shall be of steel;</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <p><b>Modification</b></p>                                                                          |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | GS                                                                                                   |
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| <p>tube sheets shall be of brass; and tubes shall be of a copper/zing/tin non-ferrous material, such as UNS C44300 (ASTM B 111) (inhibited admiralty).</p> <p>Alternative materials should be considered for salt and brackish water services. Tube materials such as 90-10 copper-nickel may be an appropriate choice for such services.</p> <p><b>Note:</b> High-pressure oil coolers can require steel tubes and tube sheets.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>Alternate materials shall use and shall be 316L stainless steel as minimum grade.</p>             |
| <b>4.5.3 Multi-plate type coolers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                      |
| <b>4.5.4 Air cooled heat exchangers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                      |
| <p>• <b>4.5.4.3</b> The purchaser may specify sizing and configuration or connections only for purchaser's separate supply of air-cooled heat exchangers.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>Refer to Project specifications.</p>                                                              |
| <p><b>4.5.4.4</b> If specified, and in addition to the requirements of the general cooler section, air coolers shall be in accordance with the following provisions a) to g).</p> <p>a) The cooler shall be provided with two fans. Each fan shall be capable of 100% of the duty requirement.</p> <p>• b) If specified, the cooler tubes shall be austenitic stainless steel.</p> <p>• c) If specified, the header boxes shall be made of hardened stainless steel plate. The header plug material shall be selected to prevent galling.</p> <p>d) Two separate headers shall be provided for each cooler.</p> <p>e) Electronic vibration switches shall be provided for each fan and shall alarm on high vibration.</p> <p>f) Refer to ISO 13706:2005, 7.2.8.2, for belt drive requirements.</p> <p><b>Note:</b> For the purposes of this provision, API Std 661 is equivalent to ISO 13706.</p> <p>g) Turbulence promoters may only be used with purchaser approval. When supplied, turbulence promoters shall be austenitic</p> | <p>b) Cooler tubes shall be 316L SS minimum grade material.</p> <p>c) This clause is applicable.</p> |

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| stainless steel.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                             |
| <b>4.6 Filters</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                             |
| <b>4.6.2</b> If specified for duplex filter arrangements where the filters are not in accordance with 4.6.1 g), the Vendor shall provide thermal over-pressure protection of the offline filter.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | This paragraph is applicable.                                                                                               |
| <ul style="list-style-type: none"> <li><b>4.6.3</b> If specified, duplex oil filter clean-side oil drains shall be manifolded together with duplex cooler drains.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Cooler oil drains shall be manifolded with filter clean side oil only when easily practical.                                |
| <ul style="list-style-type: none"> <li><b>4.6.4</b> If specified, the filter vents shall be routed back to the oil reservoir through flow indicators.</li> </ul> <p><b>Note:</b> These filter vent lines are normally run with tubing.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | This paragraph is applicable. These vent lines shall be made of piping.                                                     |
| <p><b>4.6.6</b> Filter cartridge materials shall be water- and corrosion-resistant and in accordance with the following provisions a) to d).</p> <p>a) Water-resistant filter cartridges shall not deteriorate if water contamination in the oil reaches 5% by volume and the operating temperature reaches as high as 70°C (160°F).</p> <ul style="list-style-type: none"> <li>b) If specified, filter-element media shall be non-hygroscopic. If water contamination in the oil reaches 5% for extended periods of time (up to 3 months), clean filter cartridges shall not have a clean-filter pressure drop greater than 60 kPa (0.60 bar; 10 psi) at rated oil viscosity, flow and temperature.</li> </ul> <p><b>Note:</b> This is a design requirement for filter elements and not for system operation.</p> <ul style="list-style-type: none"> <li>c) When specific filter element or cartridge is required, the purchaser shall completely specify the make, the model number and the type of construction.</li> </ul> <p>d) Metal mesh or stainless metal filter elements are not acceptable.</p> | <p>b) This clause is applicable.</p> <p>c) This clause is applicable.</p>                                                   |
| <ul style="list-style-type: none"> <li><b>4.6.11</b> When required, or if specified, more stringent requirements for control-oil filtration shall be provided.</li> </ul> <p>Filtration requirements of serviced equipment,</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | More stringent requirement shall be specified by the vendor in accordance with the requirements of the serviced equipments. |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                       | GS                                                                                                                                                                            |
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| such as hydraulic servo-valves, should be utilized in determining filtration requirements.                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                               |
| <b>4.7 Transfer Valves</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                               |
| <ul style="list-style-type: none"> <li>• <b>4.7.3</b> Transfer valves shall have steel bodies. Valve stems and valve plugs or balls shall be made of austenitic stainless steel.</li> </ul>                                                                                                                                                                                                                                     | <b>Modification</b><br>Transfer valves shall be always 316 SS minimum grade including trim and casing.                                                                        |
| <ul style="list-style-type: none"> <li>• <b>4.7.4</b> Spectacle blinds shall be provided if specified to assure tight shutoff.</li> </ul> <p><b>Note 1:</b> Transfer valves are not intended for use as tight shutoff devices for the maintenance of filters and coolers (see 7.3.3.8 h)).</p> <ul style="list-style-type: none"> <li>• <b>Note 2:</b> Transfer valves with resilient seats provide tighter shutoff.</li> </ul> | Tight shut-off valves for the maintenance of filters and coolers shall be provided.                                                                                           |
| <b>4.8 Accumulators</b>                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                               |
| <ul style="list-style-type: none"> <li>• <b>4.8.4</b> For direct-contact-type accumulators, a manual precharge valve or a constant-pressure regulating system shall be furnished as specified by the purchaser (see Figure B.19).</li> </ul>                                                                                                                                                                                    | In case of direct contact type accumulator, a constant pressure regulating system shall be provided.                                                                          |
| <ul style="list-style-type: none"> <li>• <b>4.8.8</b> If specified, the accumulator shall be equipped to maintain the contained oil at the required system oil temperature. The purchaser shall provide the details of the required temperature-control system.</li> </ul>                                                                                                                                                      | Vendor standard shall apply.                                                                                                                                                  |
| <b>4.8.10</b> If specified, bladder-type accumulators provided with a constant-pressure regulating system for pump switchover or other purposes shall automatically vent and automatically reset. Accumulators shall be provided with a gas-side anti-extrusion feature and adequately sized for the charge-gas regulator and piping.                                                                                           | This paragraph is applicable.                                                                                                                                                 |
| <b>4.9 Overhead tanks</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                               |
| <b>4.9.1 Seal-oil tanks</b>                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                               |
| <ul style="list-style-type: none"> <li>• <b>4.9.1.2</b> Each overhead seal-oil tank (see Figure 1) shall be sized so that the oil capacity above the low-level alarm setting is equal to a 2 min flow at normal seal-oil rates, and each tank shall have the capacity for a 10 min flow from low-level alarm to low-low-level shut-</li> </ul>                                                                                  | As from the low level trip, the capacity shall be such that oil is supplied to the compressor at normal flow rates over the full depressurizing time of the compression unit. |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | GS                                   |
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| <p>down plus sufficient time (as specified by the purchaser but not less than 3 min at normal flow rates after shut-down) for coast-down, block-in and depressurization of the equipment. Larger tanks can be required for special operating conditions, such as rapid depressurization of high pressure equipment. The vapour column above the high-level alarm setting shall be no less than 1 min of normal flow.</p> <p>The purchaser and the Manufacturer together shall determine the required capacity after trip, based on the compressor block-in and blowdown and the seal-oil flow rate for various conditions.</p>                                                                                                                                                                                                                                                                                                                                                                                                                       |                                      |
| <p><b>4.9.1.3</b> Overhead seal-oil tanks shall be designed in accordance with the specified pressure design code and, if specified, shall be code stamped.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>This paragraph is applicable.</p> |
| <p><b>4.9.1.4</b> Overhead seal-oil tanks shall be provided with the following items a) to g):</p> <p>a) One bottom outlet nozzle, at least DN 150 (NPS 6) in size, which shall not extend inside the vessel; this nozzle shall be used for internal access and inspection.</p> <p>b) One reference gas connection at least DN 25 (NPS 1) in size.</p> <p>c) Reference line that shall be routed to prevent traps that can accumulate liquid.</p> <p>d) Full-length reflex-type level glass that extends from 25 mm (1 in) above the high-level alarm to 25 mm (1 in) below the low-level shutdown.</p> <p>e) One DN 150 x DN 50 (NPS 6 x NPS 2) flanged reducing spacer that is 450 mm (18 in) long and is fitted to the bottom outlet connection.</p> <ul style="list-style-type: none"> <li>f) If specified, e.g. for dirty, sludge-building gas service, the reducing spacer shall project into the bottom nozzle and a valved blowdown connection shall be provided (see Figure 2); the nozzle shall be at least 200 mm (8 in) long.</li> </ul> | <p>f) This clause is applicable.</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| g) Level transmitter externally mounted to the tank and provided with isolation valves, a vent connection and a valved drain.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>4.9.1.5</b> If specified, the reference gas shall be isolated from the seal oil by a bladder of material suitable for the service (see Figure B.17).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | This paragraph is not applicable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>4.9.2 Lube-oil rundown tanks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li>If specified, a separately mounted emergency lube-oil rundown tank (either atmospheric or pressurized) shall provide oil for the coast-down period specified by the purchaser. This tank shall be sized for not less than 3 min of normal operating lube-oil flow (see Figures B.15 and B.16). Unless otherwise specified, the tank shall be made of austenitic stainless steel.</li> </ul> <p>Coast-down time shall be provided by the purchaser (normally the Supplier of the equipment served by the oil system).</p> <p><b>Note:</b> The minimum sizing criteria results in more than 3 min of coast-down oil flow due to supply pressure decay.</p>                                                                                                                                                  | <p>A lube oil rundown tank shall be provided if no emergency backup pump is supplied by the Vendor.</p> <p>If a separately mounted emergency lube oil rundown tank is required, its capacity shall be such that oil is supplied to the bearings over the full rundown time till standstill (whatever the type of SD -pressurized or depressurized-initiated from full and no load state whatever the worst). Lube oil run down tank shall always be made of 316L stainless steel as minimum grade.</p> |
| <b>4.10 Seal-oil drain traps</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li><b>4.10.1</b> One drain trap per seal shall be provided. An emergency line and isolating valves and valve to cross-connect trap inlets and permit trap maintenance shall be provided where seals operate at the same oil-sealing pressure (see Figure B.14).</li> <li>a) If specified, spectacle blinds shall be provided to isolate individual seal-oil drain traps during maintenance.</li> <li>b) Drainer bypass orifices shall be a minimum of 1 1/2 in (1116 in).</li> <li>c) Automatic seal traps are required. For gas pressures less than or equal to 5 MPa (50 bar; 725 psig), mechanical float-type traps are permitted. The float and trim shall be the single-lever, stainless steel design and arranged so that the gas flow does not impinge upon the float or float mechanisms.</li> </ul> | <p>a) Spectacle blinds or double block and bleed valves shall be provided when positive isolation is required for maintenance.</p>                                                                                                                                                                                                                                                                                                                                                                     |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | GS                                                                                                                                                                                                                                                                                     |
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| <p>Level transmitter control-type traps should be used when gas fouling can interfere with the operation of mechanical float-type traps.</p> <p>d) For pressures greater than 5 MPa (50 bar; 725 psig), snap-acting level transmitter controllers and separate control valves shall be used.</p> <p>e) Drain traps shall be pre-piped and mounted in a package arrangement. All appurtenances shall be located within the confines of the package base. Manually operated drain valves shall be provided on each trap.</p> |                                                                                                                                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li>• <b>4.10.4</b> The seal-gas vent piping arrangement shall be jointly developed by the purchaser and the Vendor. Consideration should be given to avoid pocketing of liquids, system backpressure, motive flow available and other issues.</li> </ul> <p><b>Note:</b> The arrangement of seal-gas vent piping is important to the proper function of the compressor shaft seals.</p>                                                                                                | <p>The vent piping arrangement shall be either designed by the Vendor or approved by the Vendor if designed by the Company.</p>                                                                                                                                                        |
| <ul style="list-style-type: none"> <li>• <b>4.10.5</b> The drain line for each trap shall be piped to a proper disposal system, to the degassing drum or to the reservoir, as specified.</li> </ul>                                                                                                                                                                                                                                                                                                                        | <p>This paragraph is applicable.</p>                                                                                                                                                                                                                                                   |
| <ul style="list-style-type: none"> <li>• <b>4.10.6</b> If specified, drain lines for each trap shall be piped separately.</li> </ul> <p><b>Note:</b> Separate piping of the drain lines allows the leakage from each seal to be monitored.</p>                                                                                                                                                                                                                                                                             | <p>This paragraph is applicable.</p>                                                                                                                                                                                                                                                   |
| <ul style="list-style-type: none"> <li>• <b>4.11 Degassing drum</b></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li>• <b>4.11.1</b> If specified, seal-oil degassing facilities shall be provided. Unless otherwise specified, the tank and internals shall be made of austenitic stainless steel.</li> </ul>                                                                                                                                                                                                                                                                                           | <p>This paragraph is applicable but material shall be 316L stainless steel as a minimum grade.</p>                                                                                                                                                                                     |
| <ul style="list-style-type: none"> <li>• <b>4.11.3</b> If specified, an electric immersion heater, steam heater or some other method of heating shall be provided to assist in degassing the oil. If a steam heater is used, it shall be external to the drum and shall be removable. If an electric immersion heater is used, its heat flow (power) density shall not exceed 2 W/cm<sup>2</sup> (15 W/in<sup>2</sup>). Electric heater</li> </ul>                                                                         | <p>An electric immersion heater shall be provided to assist in degassing the oil. Heater shall be removable type without degassing drum draining. The degassing drum will be provided with a set of additional flanges located at the bottom for nitrogen bubbling/purging device.</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                             | GS                                                                                                                                                                                                                               |
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| elements shall be sheathed in austenitic stainless steel; copper or copper-bearing materials shall not contact the oil. The Vendor shall provide temperature element and controls for the heater as mutually agreed upon with the purchaser.<br><br>• Electric immersion heaters should be interlocked by the purchaser to be de-energized when the oil level drops below the heater. |                                                                                                                                                                                                                                  |
| <b>4.11.5</b> The drum shall have a 4-hour minimum retention time, based on the guaranteed total inner-seal oil leakage rate or a minimum liquid volumetric capacity of 60 l (15 gal) per compressor body.                                                                                                                                                                            | In addition, the capacity of the degassing drum will allow the seal oil to recover 100% of its flash point original value at the end of the predicted retention time. The Vendor shall provide the sizing criteria with the bid. |
| • <b>4.11.6</b> If specified, the degassing drum shall be designed and constructed for pressurized service in accordance with the specified code and, if specified by the purchaser, shall be code stamped. The degassing drum shall permit discharge of the gas to the compressor suction or to a disposal outlet.                                                                   | This paragraph is applicable.                                                                                                                                                                                                    |
| <b>5. Piping</b>                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                  |
| <b>5.1 General</b>                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                  |
| All piping shall be in accordance with ISO 10438-1:2007, Clause 5, unless otherwise specified in 5.2 to 5.5 of this part of ISO 10438.                                                                                                                                                                                                                                                | <b>Clarification</b><br>Refer to comments included in <a href="#">ISO 10438-1</a> clause 5.1.2 to 5.1.3 which are fully applicable.                                                                                              |
| <b>6. Instrumentation, control and electrical systems</b>                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                  |
| <b>6.1 General</b>                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                  |
| <b>6.1.2 Alarm low level for oil reservoir</b>                                                                                                                                                                                                                                                                                                                                        | <b>Addition</b><br>A shut down shall be initiated on low low level.                                                                                                                                                              |
| • <b>6.2 Arrangement 1</b>                                                                                                                                                                                                                                                                                                                                                            | Not applicable.                                                                                                                                                                                                                  |
| <b>6.3 Arrangement 2</b>                                                                                                                                                                                                                                                                                                                                                              | Not applicable.                                                                                                                                                                                                                  |
| <b>6.4 Arrangement 3</b>                                                                                                                                                                                                                                                                                                                                                              | This paragraph is applicable with the following modifications included in 6.4.1 to 6.4.5.                                                                                                                                        |
| <b>6.4.1</b> Each function for which both an alarm                                                                                                                                                                                                                                                                                                                                    | Each function for which both an alarm and a                                                                                                                                                                                      |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | GS                                                                                                                                                                              |
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| and a shutdown have been specified shall be provided with three separate and independent transmitters (electronic unless specified otherwise).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | shutdown have been specified shall be provided with separate and independent transmitters and with separated impulse line whenever possible.                                    |
| <b>6.4.2</b> Each transmitter shall be independently connected to one of three multipoint, electronic, scanning-type instruments for each transmitter's input.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Clarification</b><br>Only transmitter is accepted.<br>Each transmitter shall be independently connected, electronic, scanning-type instruments for each transmitter's input. |
| <b>6.4.3</b> Each multipoint instrument shall provide both alarm and shutdown settings, separately and independently adjustable, for each transmitted input.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Each instrument shall provide both alarm and shutdown settings, separately and independently adjustable, for each transmitted input.                                            |
| <b>6.4.4</b> The shutdown and alarm function outputs from the three multipoint instruments shall be connected through "two-out-of-three" voting logic. The arrangement shall allow operation of any one alarm or shut-down function that initiates an alarm; operation of two shutdown functions monitoring the same parameter shall initiate a separate alarm and shall cause the served equipment to shut down.                                                                                                                                                                                                                                                                                                                | The first sentence of this paragraph is not applicable (no voting logic). However segregation shall be provided between alarm and trip functions.                               |
| <b>6.4.5</b> Alarm functions not associated with a shutdown function shall be provided with one single transmitter.<br>These alarm transmitters may be connected to one of the three alarm/shutdown multipoint instruments or to a separate multipoint instrument. The detailed arrangement should be jointly developed between the purchaser and the Vendor or Vendors of the oil system and the served equipment.<br><b>Note:</b> Arrangement 3 has the following advantages:<br>a) Any shutdown or alarm function can be tested at any time with the equipment in service without the need to disarm any part of the system.<br>b) Failure of any one component initiates an alarm but does not result in equipment shutdown. | These alarm transmitters shall be connected to single point instrument.                                                                                                         |

| ISO / API                                                                                                                                                                                                                                                                                                                                             | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
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| c) Use of modern, digital-instrument technology is facilitated. If the circuit is normally energized, this shall be a fail-safe arrangement to avoid spurious trips (e.g., 2-out-of-3 voting, DC power supply, UPS).                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>6.5 Instrumentation</b>                                                                                                                                                                                                                                                                                                                            | Instrumentation, Control Systems will be designed and fabricated according to Project specifications requirements.                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>6.6 Electrical systems</b>                                                                                                                                                                                                                                                                                                                         | Electrical systems shall be design in accordance to Project specifications requirements.                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>7. Inspection, testing and preparation for shipment</b>                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>7.3 Testing</b>                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>7.3.1 General</b>                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <ul style="list-style-type: none"> <li><b>7.3.1.2</b> The purchaser will specify whether the purchased oil system shall be used during the shop testing of the equipment.</li> </ul>                                                                                                                                                                  | <p>The entire purchased oil system shall be used in case of string test and/or full load test of the main equipment.</p> <p>In particular, during string/no/partial/full load test, the following shall be tested (but not limited to):</p> <ul style="list-style-type: none"> <li>Duplex oil filter change over</li> <li>If applicable, duplex lube oil cooler change over</li> <li>Auxiliary lube oil pump start-up.</li> </ul> <p>In all other cases, this shall be mutually agreed between Company and Manufacturer.</p> |
| <ul style="list-style-type: none"> <li><b>7.3.1.3</b> Complete-unit tests or other tests of the oil system and the equipment it serves shall be performed in place of or in addition to separate tests of the oil system as specified by the purchaser. Details of these tests shall be developed jointly by the purchaser and the Vendor.</li> </ul> | Complete oil consoles when separate shall be shop tested.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>7.3.3 Operational tests</b>                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <ul style="list-style-type: none"> <li><b>7.3.3.11</b> If specified, the Vendor, by unbolting and re-bolting pump inlet and discharge piping, shall demonstrate that the pump on its baseplate is in compliance with API RP 686 alignment requirements.</li> </ul>                                                                                    | This paragraph is applicable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

| General Specification                                                                                         |                         | GS EP MEC 281   |
|---------------------------------------------------------------------------------------------------------------|-------------------------|-----------------|
| Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries according to ISO 10438 / API Standard 614 |                         |                 |
| Rev.: 10                                                                                                      | Effective date: 10/2012 | Page: 48 of 111 |

## Annex C (informative) Inspector's checklist

The Vendor's representative will indicate compliance in accordance with the inspector's checklist (Appendix C) by initialling, dating, and submitting the completed checklist to the purchaser prior to shipment.

Figure B.20 is applicable.

a) Vendor shall supply Temperature Alarm Low level and Temperature Alarm High level (switches are not allowed) a) is applicable, refer to 6.4.2

f) The equalization line shall be part of the duplex filter/duplex cooler. f) is applicable and part of Figure 20.

Figure B.24

is applicable with relevant additions and modifications as included in this general specification.

10) If a demister is installed, it shall be equipped with a motor ventilator, 10) is applicable and part of clause 4.3.5.1.

27) Steam heaters are not acceptable, refer to clause 4.3.7.2.

22h) Electric heater shall be supplied, refer to clause 4.3.7.2.

Figure B.25:

a) Option A is allowed and preferred

c) Bleed valves shall not be omitted even for service below 1400 kpa, but option A shall be applied.

Figure B.26

shall be applied instead of B.27.

Figure B.29:

a) Combination isolation/bleed valve may be used and is preferred

c) Bleed valve is required even for service below 1400 kpa, but option A shall be applied.

Instruments dedicated to lube oil monitoring and instruments dedicated to seal gas monitoring shall be mounted on two separate gauge boards. Eventual mixing shall be subject to Company approval before execution.

Figure B.30

is fully applicable with a connection to facilitate the cleaning of the level indicator.

## 5. Comments to **ISO 10438-3/API Std 614**

### Part 3 - General-purpose oil systems

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | GS                                                                              |
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| <b>4. General</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                 |
| <b>4.1 Basic design</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                 |
| <ul style="list-style-type: none"> <li><b>4.1.1</b> This part of ISO 10438 covers general-purpose oil systems. Typical datasheets for general-purpose oil systems are in Appendix B. Typical piping and instrument diagrams for general-purpose oil systems are in Annex B.</li> </ul> <p>Typical inspector checklists for general-purpose oil systems are in Annex C. General-purpose (GP) oil systems are divided into classes and are defined by a coding system that defines the major components supplied (see Table 1). The user shall choose the applicable class and code based upon the required minimum reliability targets for the equipment train. Various API standards have supplied minimum recommended systems as indicated in Table 2 for their equipment. Annex D is supplied as a reference to provide guidance on the selection of a system.</p> | <p>This paragraph is applicable as well as table 1 and table 2.</p>             |
| <b>4.2 General</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                 |
| <ul style="list-style-type: none"> <li><b>4.2.2</b> The purchaser shall specify the design goal for uninterrupted operation (mission time) of the equipment.</li> </ul> <p><b>Note:</b> Annex D is available as a guide for system reliability goals.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>Refer to the equipment data sheets which shall specify the mission goal.</p> |
| <ul style="list-style-type: none"> <li><b>4.2.4</b> The purchaser shall specify the equipment's normal operating point and alternate operating points, including transients.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <p>See comments to Part 2 paragraph 4.1.4.</p>                                  |
| <ul style="list-style-type: none"> <li><b>4.2.5</b> Control of the sound pressure level (SPL) of all equipment furnished shall be a joint effort of the purchaser and the Vendor having unit responsibility. The equipment furnished by the Vendor shall conform to the maximum allowable sound pressure level specified. In order to determine compliance,</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>See comments to Part 2 paragraph 4.1.5.</p>                                  |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                     | GS                                                         |
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| the Vendor shall provide both maximum sound pressure and sound power level data per octave band for the equipment.                                                                                                                                                                                                                                                                                                            |                                                            |
| <ul style="list-style-type: none"> <li>• <b>4.2.6</b> Where oil is supplied from a common system to two or more machines (such as a compressor, a gear and a motor), the oil's characteristics shall be specified by the purchaser on the basis of mutual agreement with all Vendors supplying equipment served by the common oil system.</li> </ul>                                                                          | See comments to Part 2 paragraph 4.1.7.                    |
| <ul style="list-style-type: none"> <li>• <b>4.2.7</b> The system shall be designed to supply oil to all equipment specified.</li> </ul>                                                                                                                                                                                                                                                                                       | See comments to Part 2 paragraph 4.1.8.                    |
| <ul style="list-style-type: none"> <li>• <b>4.2.9</b> If specified, the arrangement of the equipment, including piping and auxiliaries, shall be developed jointly by the purchaser and the Vendor. The arrangement shall provide adequate clearance areas and safe access for operation and maintenance.</li> </ul>                                                                                                          | This paragraph is applicable. See Part 2 paragraph 4.1.13. |
| <ul style="list-style-type: none"> <li>• <b>4.2.10</b> If specified, minimum defined requirements for clearance around and access to component (especially clearance around and access to coolers, filters and hand valves) shall be incorporated as design requirements.</li> </ul>                                                                                                                                          | See comments to Part 2 paragraph 4.1.13.                   |
| <ul style="list-style-type: none"> <li>• <b>4.2.11</b> If specified, pumps, filters, strainers, coolers, traps, valves and all other components that retain oil under pressure and are external to the reservoir shall be made of steel.</li> </ul>                                                                                                                                                                           | This paragraph is applicable.                              |
| <ul style="list-style-type: none"> <li>• <b>4.2.13</b> If specified, valved vents, drains and piping shall be furnished to permit draining, cleaning and refilling of idle components while the equipment is in operation.</li> </ul>                                                                                                                                                                                         | This paragraph is applicable.                              |
| <ul style="list-style-type: none"> <li>• <b>4.2.14</b> Unless otherwise specified, coolers, filters, overhead oil tanks, drain traps, accumulators and other pressure vessels shall be in accordance with the specified pressure design code. If specified by the purchaser, vessels shall be code stamped.</li> </ul> <p><b>Note 1:</b> Code stamping might not be applicable for pressure design codes other than ASME.</p> | ASME code Section VIII is applicable.                      |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | GS                                                                                                           |
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| <p><b>Note 2:</b> Local jurisdictions can require a code stamp.</p> <p><b>Note 3:</b> Code stamping can require additional inspection over the life of the equipment.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                              |
| <ul style="list-style-type: none"> <li>• <b>4.2.15</b> The Vendor shall advise the purchaser of, and both parties shall mutually agree upon, any special provisions that are necessary to ensure that an adequate back-up supply of lube oil is maintained in the event of complete failure of the primary lube-oil supply system. These provisions may include standby pumps, rundown tanks and special arrangements for equipment safety and protection when the equipment decelerates. Provisions shall be adequate for coast-down time and cool-off time, as applicable. The purchaser and the Vendor shall mutually agree on the system and its components.</li> </ul>                                                                                                                                                                                                 | <p>This paragraph is fully applicable.</p>                                                                   |
| <b>4.3 Baseplates</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                              |
| <ul style="list-style-type: none"> <li>• <b>4.3.3</b> If specified, sloped decking shall be furnished.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>When baseplate designs are with decking, slope, retention device and drains shall be always provided.</p> |
| <ul style="list-style-type: none"> <li>• <b>4.3.5</b> If specified, metal decking covering all walk and work areas shall be provided on the top of the baseplate<br/>If furnished, metal decking shall be non-skid.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <p>Baseplate design shall always be supplied with metal decking covering all walk and work areas.</p>        |
| <ul style="list-style-type: none"> <li>• <b>4.3.6</b> If specified, baseplates shall be suitable for installation in accordance with API RP 686. Unless otherwise specified, all baseplates shall be provided with at least one opening or hole in each bulkhead section through which grout can be poured and vented. Each opening shall have a clear area of no less than <b>125 cm<sup>2</sup> (20 in<sup>2</sup>)</b> and no dimension less than <b>100 mm (4 in)</b>, and each shall permit filling and venting of the entire cavity with grout under the baseplate without creating air pockets. Each hole into which the grout is poured shall be accessible: no component or piping shall be disturbed and no tripping hazards in walk and work areas shall be created. Vent holes at least <b>13 mm (1/2 in)</b> in diameter shall be provided for each</li> </ul> | <p>This paragraph is applicable.</p>                                                                         |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | GS                                                            |
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| bulkhead compartment. Each grout hole shall also be provided with steel curbing <b>13 mm (1/2 in)</b> high to prevent accumulated oil or water from entering the grout. Vent holes shall be provided without curbing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                               |
| <ul style="list-style-type: none"> <li>• <b>4.3.7</b> If specified, the baseplate shall be suitable for column mounting (that is, of sufficient rigidity to be supported at specified points) without continuous grouting under structural members. The baseplate design shall be mutually agreed upon by the purchaser and the Vendor.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | This paragraph is applicable refer to Part 2 paragraph 4.2.9. |
| <b>4.4 Oil Reservoirs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                               |
| <b>4.4.4 Manways and drains</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                               |
| <ul style="list-style-type: none"> <li>• <b>4.4.4.2</b> If specified, to ensure complete drainage, the bottom of each reservoir shall be sloped to a low point drain.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | This paragraph is applicable.                                 |
| <ul style="list-style-type: none"> <li>• <b>4.4.4.3</b> If specified, a drain connection (with a valve and a blind Range) at least 50 mm (2 in) in diameter shall be provided.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | This paragraph is applicable.                                 |
| <b>4.4.5 Features and appendages</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                               |
| <p>The oil reservoir shall have the following features and appendages:</p> <p>a) Capacity to settle moisture and foreign matter adequately and to provide allowance for rundown from the entire system.</p> <p>b) Provisions to eliminate air and minimize migration of foreign matter to each pump suction.</p> <p>c) Reservoir-level indicator, such as a dipstick, level gauge, or bulls eye.</p> <ul style="list-style-type: none"> <li>• d) If specified, an oil level glass arranged to cover the span from at least 25 mm (1 in) above the rundown level to 50 mm (2 in) below the pump suction-loss level. The oil level glass shall be located as far away as possible from the oil return lines and be visible from the perimeter of the unit. The maximum and minimum operating levels, rundown level and suction-loss level shall be indicated on the glass. If more than one level glass is</li> </ul> | d) This clause is applicable.                                 |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | GS                                               |
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| <p>provided, they shall be offset. The top glass shall be of the weld pad type.</p> <p>e) Weatherproof, corrosion-resistant filter-breather cap at least 50 mm (2 in) in diameter with filtration rating of 10 pm beta 10 or better shall be provided (this connection may also be used as a fill opening).</p> <ul style="list-style-type: none"> <li>f) If specified, a fill opening at least 50 mm (2 in) in diameter that automatically closes (normally held shut by a spring) and is equipped with a stainless steel fine-mesh strainer basket that has an open area equal to 200% of the internal pipe area.</li> </ul> <p>g) Internal baffles that are not gas-tight.</p> <p>h) Individual, non-pressurized reservoir return lines that shall enter the reservoir above the maximum operating level (see ISO 10438-1:2007, Annex F).</p>                                    | <p>f) This clause is applicable.</p>             |
| <b>4.4.6.1 Capacity and configurations</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                  |
| <ul style="list-style-type: none"> <li>4.4.6.1 If specified, a low-level alarm that actuates at the minimum operating level shall be provided.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>This paragraph is applicable.</p>             |
| <b>4.4.7 Heating</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                  |
| <ul style="list-style-type: none"> <li>If specified, an electric heater shall be furnished in accordance with the following.</li> </ul> <p>a) If an electric heater is specified, a thermostatically controlled, removable electric immersion heating element shall be provided for heating the charge capacity of oil before start-up in cold weather. The device shall have the capacity to heat the oil in the reservoir from the specified minimum site ambient temperature to the Manufacturer's required start-up temperature within 12 h. Heater elements shall be sheathed in austenitic stainless steel or incoloy 2); copper or copper-bearing materials shall not contact the oil. A level interlock device shall be furnished.</p> <p>Electric immersion heaters should be level interlocked by the purchaser to be de-energized when the oil level drops below the</p> | <p>Electric heater shall always be provided.</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | GS                                                                  |
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| <p>minimum operating level.</p> <p>For heating the lube oil to minimum starting temperature, many factors, including lube pump start-up minimum oil temperature, equipment minimum oil temperature, circulating heat loss, etc., shall be considered. Many of these factors are the responsibility of the installing Contractor and should be coordinated with the console designer. Insulation, location and heat-tracing requirements shall be considerations of the installation.</p> <p>b) Direct-contact electric heaters shall have a maximum watt density of 2.32 W/cm<sup>2</sup> (1.5 W/in<sup>2</sup>).</p> <ul style="list-style-type: none"> <li>c) If specified, the heater shall be installed in a manner that allows the heater(s) to be removed during operation.</li> <li>d) The hot section of the heater element shall be located a minimum of 50 mm (2 in) below the minimum operating level.</li> </ul> | <p>c) This clause is applicable.</p>                                |
| <b>• 4.4.8 Provision for insulation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                     |
| <p>If specified, reservoirs shall be fitted with insulation clips. The purchaser shall furnish and install the insulation.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>See comments to <a href="#">ISO 10438-2</a> paragraph 4.3.8.</p> |
| <b>• 4.4.9 Plugged connections</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |
| <p>If specified, each reservoir shall be provided with one threaded and plugged connection above the rundown oil level at least DN 25 (NPS 1). This connection may be used for such services as purge gas, makeup oil supply and oil conditioner return.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>This paragraph is applicable.</p>                                |
| <b>4.4.10 Special features</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                     |
| <p><b>4.4.10.1</b> If specified, a clearly accessible ladder with extended handrails and non-skid working surface shall be provided.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p>When required, this paragraph is applicable.</p>                 |
| <p><b>4.4.10.2</b> If specified, handrails around the perimeter of the reservoir top shall be provided.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p>When required, this paragraph is applicable.</p>                 |
| <p><b>4.4.10.3</b> If specified, non-skid surface decking</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>This paragraph is applicable.</p>                                |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | GS                                                                                   |
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| shall be provided on the top of the reservoir.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                      |
| <b>4.5 Pumps and drivers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                      |
| <ul style="list-style-type: none"> <li><b>4.5.1</b> The oil system shall include an oil pump suitable for continuous operation. The purchaser shall specify whether centrifugal or rotary pumps shall be used. If specified, pumps shall conform to ISO 13709 or ASME B73.2 or ASME B73.3 for the centrifugal pumps and to API Std 676 for rotary pumps.</li> </ul> <p><b>Note:</b> For the purposes of this provision, API Std 610 is equivalent to ISO 13709.</p>                                                                                                                                                                                                                                                                                                                                                                                               | See comments to Part 2 paragraph 4.4.1.                                              |
| <ul style="list-style-type: none"> <li><b>4.5.4</b> If specified, or required by the lubricated equipment Supplier, an electric-motor-driven standby pump shall be provided for start-up and/or main-pump failure backup.</li> </ul> <p><b>Note:</b> Standby pumps are not always required. Some equipment, such as equipment utilising ring-oiled bearing lubrication, might not require pre-priming and use of a standby pump.</p>                                                                                                                                                                                                                                                                                                                                                                                                                              | This paragraph is applicable, otherwise Vendor shall demonstrate when not necessary. |
| <ul style="list-style-type: none"> <li><b>4.5.5</b> Motors shall comply with the area classification and shall comply with NEMA MG1 or applicable part(s) of IEC 60034.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Refer to Project and Electrical General specifications.                              |
| <ul style="list-style-type: none"> <li><b>4.5.14</b> If specified, for the protection of externally mounted centrifugal pumps during flushing and for the initial operation of new oil systems, a removable strainer made from austenitic stainless steel and having an open flow area equal to 150% of the cross-sectional area of the suction pipe shall be installed in the suction piping of each pump between the pump-suction Range and the block valve. The temporary strainer shall be identified by a protruding tab and shall have a mesh size adequate to stop all objects that can be injurious to the pump. The piping arrangement shall permit the removal of the strainer without disturbing the alignment of the pump. The maximum strainer hole size shall be 3 mm (118 in).</li> </ul> <p><b>Note:</b> Strainer can be cone-, basket- or Y-</p> | This paragraph is applicable.                                                        |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | GS                                  |
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| type.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |
| <p><b>4.5.19</b> For drivers larger than 7.5 kW (10 hp), mounting plates shall be provided with the following specifications.</p> <p><b>Note:</b> Reference can be made to 4.5.5, second paragraph.</p> <ul style="list-style-type: none"> <li>a) If specified, mounting pads shall be provided for each pump and its driver. Pads shall be at least 25 mm (1 in) larger than the feet of the mounted equipment to allow for levelling of the console or package baseplate without removal of the equipment. The pads shall be fully machined, flat and parallel. Corresponding surfaces shall be in the same plane within 125 µm/m (0.002 in/ft) of distance between the pads. To prevent distortion, machining of mounting pads shall be deferred until welding on the baseplate in close proximity to the mounting pads has been completed. This tolerance shall be met at the time of assembly at the Vendor's shop between coupled rotating pieces of equipment. The coupled pieces shall be capable of being re-aligned in the field when the console is properly installed in accordance with API RP 686.</li> <li>b) Pumps and drivers shall be mounted on a machined surface. All pads for oil pumps and drivers shall be machined to allow for the installation of stainless steel shims; shim packs, at least 3 mm (118 in) thick, shall be placed under the feet of each component.</li> </ul> <p><b>Note:</b> Due to mounting surface tolerances on purchased pumps and drivers, it can be necessary to install shims of different thicknesses under each foot. Additionally, shims under the pump are required to allow future shimming of a replacement pump to the inlet pipe. (The small-PD pump tolerance equals 130 µm (0.0058 in) from foot to foot, and the NEMA motor and large-PD pump tolerance equals 260 µm (0.0108 in) from foot to foot.).</p> <li>c) To minimize misalignment of the pump and</li> | <p>a) This clause is applicable</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| <p>driver shafts due to piping-load effects, the pump and its baseplate shall be constructed with sufficient structural stiffness to limit total misalignment to the values specified in 4.5.18 b).</p> <p>d) When the pump and driver are mounted on the console without a separate sub-base, the pump and driver shall be affixed to a structural member of the console base rather than merely being attached to deckplate or other non-structural components.</p> <ul style="list-style-type: none"> <li>e) If specified, or when drivers exceed <b>45 kg (100 lb)</b>, transverse- and axial-alignment positioning jackscrews shall be provided for all pump drivers. The lugs holding these positioning screws shall be attached to the baseplate so that the lugs do not interfere with the installation or removal of the component. Alignment positioning screws shall be at least the same size as the jackscrews furnished with each component.</li> <li>f) Supports, jack screws and their attachments shall be rigid enough to permit the machine to be moved by the use of its lateral and axial jackscrews when provided.</li> </ul> | <p>e) This clause is applicable.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>4.6 Coolers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <p><b>4.6.1.2</b> Coolers (if required by 4.6.1.1) shall be in accordance with the requirements as follows, and unless otherwise specified shall be shell-and-tube type.</p> <ul style="list-style-type: none"> <li>If specified, a plate frame or fin-fan cooler shall be supplied. The Vendor shall include in the proposal complete details of any proposed air-cooled or plate frame cooler.</li> </ul> <p><b>Note:</b> Reference can be made to 4.6.3 for plate frame coolers and to 4.6.4 for fin-fan coolers.</p> <ul style="list-style-type: none"> <li>b) If specified, the Vendor shall supply connections for installation of the purchaser's fin-fan oil cooler(s) off the oil console.</li> <li>c) When the purchaser supplies the off-console cooler(s), the elevation and runback volume shall be provided to the console</li> </ul>                                                                                                                                                                                                                                                                                                 | <p>Refer to <a href="#">ISO 10438-2</a> paragraph 4.5.1.3.</p> <p><b>Clarification</b></p> <p>Each cooler shall be sized to accommodate 120% of the total cooling load. In case of air coolers, fans and motors shall be sized accordingly.</p> <p>A cooling air system must comply with Each cooler shall be sized for 120% of thermal load at maximum ambient temperature. If air coolers are used, the rated thermal duty must be met with one fan off.</p> <p>All fans, shafts, coupling and other moving parts of mechanical equipment shall be supplied with non sparking protective guards.</p> <p>All lubrication fittings shall be extended to points outside of guards easily accessible allowing servicing during operation without</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | GS                                                                                                                                                   |
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| <p>Supplier in order to properly size pressure drop criteria for the oil side, which shall be mutually agreed upon between the Vendor and purchaser.</p> <p>d) Unless otherwise specified for duplex cooler arrangements, the equalization/fill valve shall be locked or car sealed in the open position with the equalization/fill line orifice thermally sized by the Vendor to provide thermal overprotection.</p> <ul style="list-style-type: none"> <li>e) If specified in lieu of the requirements of d) for duplex cooler arrangements, the Vendor shall provide thermal over-pressure protection of the oil side of the coolers by providing separate thermal relief valves.</li> <li>f) If specified, a cooling water system or systems shall be designed for the following conditions: <ul style="list-style-type: none"> <li>Velocity over heat-exchange surfaces <b>1.5 m/s to 2.5 m/s</b> (5 ft/s to 8 ft/s)</li> <li>Maximum allowable working pressure <math>\geq 690</math> kPa (<math>\geq 100</math> psig)</li> <li>Test pressure <math>\geq 1.5 \times \text{MAWP} \geq 1.03</math> kPa (<math>\geq 150</math> psig)</li> <li>Maximum pressure drop <b>103 kPa</b> (15 psig)</li> <li>Maximum inlet temperature <b>30°C</b> (90°F)</li> <li>Maximum outlet temperature <b>50°C</b> (120°F)</li> <li>Maximum temperature rise <b>20K</b> (30°R)</li> <li>Minimum temperature rise <b>10K</b> (20°R)</li> <li>Fouling factor on water side <b>0.35 m<sup>2</sup> K/kW</b> (0.002 hr-ft<sup>2</sup>°F/Btu)</li> <li>Carbon steel corrosion allowance <b>1.5 mm</b> (0.063 in).</li> </ul> </li> <li>g) Provision shall be made for complete venting and draining of the system or systems.</li> <li>h) The Vendor shall notify the purchaser if the criteria for minimum temperature rise and velocity over heat-exchange surfaces result in a conflict. The criterion for velocity over heat-</li> </ul> | <p>removing guards.</p> <p>Each fan shall be provided with a vibration shutdown switch of manual reset type, interfaced with unit control panel.</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | GS                                                                                                                                                         |
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| <p>exchange surfaces is intended to minimize water-side fouling; the criterion for minimum temperature rise is intended to minimize the use of cooling water. The purchaser shall approve the final selection.</p> <p>i) Oil coolers shall have the following characteristics.</p> <ol style="list-style-type: none"> <li>1) Each cooler shall be sized to accommodate the total cooling load.</li> <li>2) Oil coolers shall not be located inside the reservoir.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                            |
| <ul style="list-style-type: none"> <li>• <b>4.6.1.3</b> If specified, an oil bypass line around the cooler with a temperature-control valve shall be included to regulate the oil-supply temperature. This includes oil systems where the purchaser supplies the cooler. In no case, however, shall oil bypass the filter. The control valve shall be in accordance with the following provisions a) to d).</li> </ul> <p><b>Note:</b> When fouling or freezing of the water side of a cooler is a factor, and oil temperature is regulated by adjusting water flow through the cooler, it is possible for the cooler water-side to silt up or freeze and break at low water-flow rates.</p> <p>a) Unless otherwise specified, the oil by-pass valve shall be a thermostatically operated three-port valve.</p> <ul style="list-style-type: none"> <li>• b) If specified, the oil bypass valve shall be a flanged and pneumatically operated (air-to open fail-close), two-port or three-port, temperature control valve. Failure of the control valve shall cause all the oil to pass through the cooler.</li> </ul> <p><b>Note:</b> Three-port valves can direct the oil more advantageously due to system pressure drops and allows all of the oil to bypass the cooler; however, they can complicate bypass arrangements required for maintenance versus a two-port valve.</p> <ul style="list-style-type: none"> <li>• c) If specified, the temperature control valve shall be provided with a manual override that permits operation independent of</li> </ul> | <p>This paragraph is applicable.</p> <p>b) The oil bypass valve shall be self operated or pneumatically operated.</p> <p>c) This clause is applicable.</p> |

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| temperature conditions.<br>d) The temperature control valve shall be sized to handle all oil flow passing through the cooler. For a three- way temperature control valve, the pressure drop should not exceed that through the cooler. For a two-way temperature control valve, pressure drop should not exceed 50% of the pressure drop through the cooler.                                                                                                                                                                                                               |                                                                  |
| <ul style="list-style-type: none"> <li>• <b>4.6.1.5</b> If specified, shell-and-tube or plate-frame coolers shall be suitable for use of a 150°C (300°F) heating medium, such as steam or a mixture of steam and water. Steam may be used for auxiliary heating on start-up by sparging it into the cooling water. Steam should not be introduced directly into the cooler.</li> </ul>                                                                                                                                                                                     | See comments to Part 2 paragraph 4.5.1.15.                       |
| <ul style="list-style-type: none"> <li>• <b>4.6.1.7</b> If specified, the coolers shall be fabricated with flanged vent and drain nozzles. Screwed and seal-welded or socket-welded pipe and flange additions to coolers after cooler certification is not acceptable.</li> </ul>                                                                                                                                                                                                                                                                                          | This paragraph is applicable.                                    |
| <ul style="list-style-type: none"> <li>• <b>4.6.1.8</b> If specified, cooler oil drains shall be manifolded together with filter clean-side oil drains.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                         | This paragraph is applicable.                                    |
| <ul style="list-style-type: none"> <li>• <b>4.6.1.9</b> If specified, vents on the oil side shall be piped back to the reservoir through flow indicators.</li> </ul> <p><b>Note:</b> These vent lines are normally tubed.</p>                                                                                                                                                                                                                                                                                                                                              | This paragraph is applicable; however vent lines shall be piped. |
| <b>4.6.2 Shell-and-tube coolers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                  |
| <p><b>4.6.2.1</b> In addition to the requirements of 4.6.1, shell-and-tube coolers shall be in accordance with the following.</p> <p>a) Shell-and-tube coolers shall have water on the tube side. Unless otherwise specified, a removable-bundle design is required for coolers with more than 0.5 m<sup>2</sup> (5 ft<sup>2</sup>) of heat-transfer area. Removable-bundle coolers shall be in accordance with TEMA Class C or other heat exchanger code specified and shall be constructed with a removable channel cover. Nominal tube outside diameter shall be at</p> |                                                                  |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | GS                                                                                       |
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| <p>least 9 mm (3/8 in) and nominal tube wall thickness shall be at least 18 BWG (1.245 mm; 0.049 in). U-bend tubes may be supplied with purchaser's approval (see 4.6.2.2).</p> <p><b>Note:</b> Some non-repairable coolers might be available in thinner tubes. 26 BWG 10.457 mm (0.018 in) in 3/8 tube is commonly available.</p> <p>b) To prevent the oil from being contaminated if the cooler fails, the oil-side operating pressure shall be higher than the water-side operating pressure, unless otherwise specified.</p> <ul style="list-style-type: none"> <li>c) If specified, the oil-side operating pressure shall be lower than the water side operating pressure.</li> </ul> <p><b>Note:</b> Concerns with oil leakage into the water, especially on once-through water systems, can outweigh equipment protection concerns.</p> <p>d) Unless otherwise specified, fin tubes or extended-surface tubes are allowed.</p> | <p>c) This clause is not applicable.</p>                                                 |
| <ul style="list-style-type: none"> <li><b>4.6.2.4</b> If specified, alternate materials shall be provided for cooler shells, tubes, channels and covers.</li> </ul> <p>Alternate materials should be considered for salt- and brackish-water services. Tube materials such as 90-10 copper-nickel can be an appropriate choice for such services. Stainless steel tubes are generally not recommended because of chloride-cracking problems in salt- and brackish-water services and poorer heat transfer characteristics.</p>                                                                                                                                                                                                                                                                                                                                                                                                         | <p>Alternate materials shall use and shall be 316L stainless steel as minimum grade.</p> |
| <b>4.6.3 Multi-plate type coolers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                          |
| <p><b>4.6.3.1</b> If specified, and in addition to the requirements of the general cooler section, multi-plate type coolers shall be in accordance with the following.</p> <p>a) Multi-plate coolers shall have plates of austenitic stainless steel for fresh-water cooling or titanium for brackish or salt water,</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                          |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | GS                                                                                                                                                                                                                                                                                                                                                                                                                                       |
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| <p>or as specified by the purchaser.</p> <p>b) To prevent the oil from being contaminated if the cooler fails, the oil-side operating pressure shall be higher than the water-side operating pressure, unless otherwise specified.</p> <ul style="list-style-type: none"> <li>c) If specified, the oil-side operating pressure shall be lower than the water-side operating pressure.</li> </ul> <p><b>Note:</b> Concerns with oil leakage into the water, especially on once-through water systems, can outweigh equipment protection concerns.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p>c) The oil-side operating pressure shall be always higher than the water-side operating pressure.</p>                                                                                                                                                                                                                                                                                                                                 |
| <b>4.6.4 Air-cooled heat exchangers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <ul style="list-style-type: none"> <li><b>4.6.4.2</b> The purchaser may specify sizing and configuration or connections only for purchaser separate supply of air cooled heat exchangers.</li> <li><b>4.6.4.3</b> If specified, fin-fan type coolers shall be provided. If provided, in addition to the requirements of 4.6.1, they shall be in accordance with the following provisions a) to h).</li> <li>a) If specified, the cooler shall be provided with two fans. Each fan shall be capable of 100% of the duty requirement.</li> <li>b) If specified, the cooler tubes shall be austenitic stainless steel.</li> <li>c) If specified, the header boxes shall be made of stainless steel plate. The header plug material shall be selected to prevent galling.</li> <li>d) An inlet header and an outlet header shall be provided for each cooler.</li> <li>e) If specified, vibration detectors shall be provided for each fan and shall alarm on high vibration.</li> <li>f) Belt drive requirements shall be in accordance with ISO 13706:2005, 7.2.</li> </ul> <p><b>Note:</b> For the purposes of this provision. API Std 661 is equivalent to ISO 13706.</p> | <p>Refer to equipment data sheets.</p> <p>a) 3 x 50% fans are acceptable, however cooler bundle shall be design for 120% heat load.</p> <p>b) Cooler tubes shall be always 316L stainless steel as minimum grade.</p> <p>c) Header boxes shall also be made of 316L stainless steel as minimum grade.</p> <p>e) Vibration detector shall always be provided by Vendor for each fan. Alarm and shutdown thresholds shall be provided.</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | GS                                       |
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| <p>g) Turbulence promoters may be used only with purchaser approval. When supplied, promoters shall be austenitic stainless steel.</p> <p>h) Cooler headers shall be made of carbon steel.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                          |
| <b>4.7 Filters</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                          |
| <p><b>4.7.1</b> Duplex replaceable full-flow filter with replaceable elements or cartridges shall be provided. Filters shall provide a minimum particle removal efficiency, <b>EpR</b>, of 90% for 10 µm particles (<math>\beta_{10} \geq 10</math>), and a minimum <b>EpR</b> of 99.5% of 15 µm particles (<math>\beta_{15} \geq 200</math>), both in accordance with ISO 16889 when tested to a minimum terminal (end-of-test run) differential pressure of 350 kPa (3.5 bar; 50 psid). Filter installations shall be in accordance with the following provisions a) to g).</p> <p><b>Note 1:</b> Reference can be made to ISO 10438-1:2007, Annex D, for additional information concerning filter ratings.</p> <p><b>Note 2:</b> These filtration levels are based on the film thickness in hydrodynamic bearings. The film thickness of rolling element bearings is typically in the range of 0.1 µm. Considerations of oil-film thickness and particle hardness can require even finer filtration levels.</p> <ul style="list-style-type: none"> <li>a) If specified, a single filter shall be provided.</li> <li>b) The filters shall be located downstream of the coolers.</li> </ul> <p><b>Note:</b> Coolers can <b>trap</b> and release dirt and debris.</p> <p>c) The filters shall be piped in a parallel arrangement using a continuous-flow transfer valve (see 4.8).</p> <p>d) Filter cases and heads shall be suitable for operation at the maximum discharge pressure (at the trip speed for turbine drives) of centrifugal pumps or at a pressure not less than the pressure-limiting device setting of</p> | <p>a) This clause is not applicable.</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | GS                                                                                 |
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| <p>positive-displacement pumps.</p> <p>e) Filters that have covers weighing more than 15 kg (35 lbm) shall have cover lifters.</p> <p>f) The filters shall not be equipped with differential pressure-limiting valves or other valves that can cause bypass of unfiltered (dirty) oil around the filter elements.</p> <p>g) The filters shall be equipped with NPS-pipe-size plugged or blind-flanged vent and drain connections.</p>                                                                                                                                                                                                                                        |                                                                                    |
| <ul style="list-style-type: none"> <li>• <b>4.7.3</b> If specified for duplex filter arrangements where the filters are not in accordance with <b>4.7.2</b>, the Vendor shall provide thermal over-pressure protection of the off-line filter.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>This paragraph is applicable.</p>                                               |
| <ul style="list-style-type: none"> <li>• <b>4.7.4</b> If specified, duplex oil-filter clean-side oil drains shall be manifolded together with duplex cooler drains.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>Vendor standard shall apply.</p>                                                |
| <ul style="list-style-type: none"> <li>• <b>4.7.5</b> If specified, the filter vents shall be routed back to the oil reservoir.</li> </ul> <p><b>Note:</b> These filter vent lines are normally run with tubing.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <p>This paragraph is applicable; however the vent line shall be run with pipe.</p> |
| <ul style="list-style-type: none"> <li>• <b>4.7.6</b> If specified, the filter vents lines specified in <b>4.7.5</b> shall have flow indicators.</li> </ul> <p><b>Note:</b> These filter vent lines are normally run with tubing.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p>This paragraph is applicable; however the vent line shall be run with pipe.</p> |
| <p><b>4.7.7</b> Oil-filter design shall be in accordance with the following provisions a) to p).</p> <p>a) Oil shall flow from the outside inward toward the centre of the filter element.</p> <p>b) Oil flow from the centre towards the outside of the filter element may be provided with purchasers approval.</p> <p>c) Adequate support of the filter elements shall be provided to prevent them from rupturing or to prevent unfiltered (dirty) oil from bypassing the elements and reaching the equipment.</p> <p>d) Centre posts and other hardware in contact with filtered oil that are not integral with the filter housing shall be made of stainless steel.</p> |                                                                                    |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | GS                                                                            |
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| <p>e) The maximum number of filter cartridges permitted in one stack shall be two.</p> <p>f) If the cartridge-to-cartridge joint is not self-aligning, a collar shall be used between the stacked cartridges to ensure alignment.</p> <p>g) Filter stacks shall not exceed 1 m (3 ft).</p> <p>h) Stacked cartridges shall have adequate support and maintainable alignment.</p> <p>i) It shall be possible to drain oil from the filter housing while avoiding contamination of the downstream (clean) side with unfiltered (dirty) oil during replacement of the filter elements.</p> <p>j) Filter cartridge materials shall be water- and corrosion-resistant.</p> <p>k) Water-resistant filter cartridges shall not deteriorate if water contamination in the oil reaches 5% by volume and the operating temperature, as high as 70°C (160°F).</p> <ul style="list-style-type: none"> <li>l) If specified, filter element media shall be non-hydroscopic. Clean filter cartridges shall not have more than two times the clean-filter pressure drop at the rated oil viscosity, flow and temperature with water contamination of up to 5%.</li> <li>m) When a specific filter element or cartridge is required, the purchaser shall completely specify the make, the model number and the type of construction.</li> </ul> <p>n) Metal mesh or sintered metal filter elements are not acceptable.</p> <p>o) The pressure drop for clean filter elements or cartridges shall not exceed 30 kPa (0.30 bar; 5 psi) at an operating temperature of 40°C (100°F) and normal tiow. Pressure drop across the total filter system may exceed these values by the amount of pressure drop across the transfer valve and other filter-system components.</p> <p><b>Note:</b> The 30 kPa (0.30 bar; 5 psi) is the difference between the drop across the filter housing with no elements installed and the drop across the filter housing with clean elements installed.</p> | <p>l) This clause is applicable.</p> <p>m) This clause is not applicable.</p> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | GS                                                                                                                      |
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| p) Elements or cartridges shall have a minimum collapsing differential pressure of 500 kPa (5 bar; 70 psi).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                         |
| <b>4.8 Transfer valves</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                         |
| <ul style="list-style-type: none"> <li><b>4.8.4</b> Spectacle blinds shall be provided, if specified or if required to assure tight shutoff.</li> </ul> <p><b>Note 1:</b> Transfer valves are not intended for use as tight shutoff devices for the maintenance of filters and coolers (see 7.3.3.7 g)).</p> <p><b>Note 2:</b> Transfer valves with resilient seats provide tighter shutoff.</p>                                                                                                                                                                                                                                                                                                                        | See comments to <a href="#">ISO 10438-2</a> paragraph 4.7.4.                                                            |
| <b>4.9 Lube-oil rundown tanks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                         |
| <ul style="list-style-type: none"> <li><b>4.9.1</b> If specified, a separately mounted emergency lube-oil rundown tank (either atmospheric or pressurized) shall provide oil for the coast-down period specified by the purchaser. This tank shall be sized for not less than 3 min of normal operating lube-oil flow (see ISO 10438-2:2007, Figures B.15 and B.16). Unless otherwise specified, the tank shall be made of austenitic stainless steel. Coast-down time shall be provided by the purchaser (normally the Supplier of the equipment served by the oil system).</li> </ul> <p><b>Note:</b> The minimum sizing criteria results in more than 3 min of coast-down oil flow due to supply-pressure decay.</p> | See comments to <a href="#">ISO 10438-2</a> paragraph 4.9.2.                                                            |
| <b>5. Piping</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                         |
| <b>5.1 General</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                         |
| <b>5.1.1</b> All piping shall be in accordance with ISO 10438-1:2007, Clause 5, unless otherwise specified in 5.1.2 and 5.1.3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Clarification</b><br>Comments included in <a href="#">ISO 10438-1</a> paragraph 5.1.2 to 5.1.3 are fully applicable. |
| <ul style="list-style-type: none"> <li><b>5.1.3</b> If specified, radiographic requirements associated with pipe fabrication shall be in accordance with the specified code.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Requirements shall be in accordance with ASME code.                                                                     |
| <b>6. Instrumentation and electrical systems</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                         |
| <ul style="list-style-type: none"> <li><b>6.1</b> Instrumentation shall be in accordance</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Modification</b>                                                                                                     |

| ISO / API                                                                                                                                                                                                                                                                                                                                               | GS                                                                                                                        |
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| with ISO 10438-1:2007, Clause 6, except as modified in 6.2 to 6.4.                                                                                                                                                                                                                                                                                      | Instrumentation and electrical systems shall be designed and fabricated according to Project specifications requirements. |
| <ul style="list-style-type: none"> <li>• <b>6.3</b> Unless otherwise specified, the requirements of ISO 10438-1:2007, 6.2.1 I), are not applicable.</li> </ul> <p><b>Note:</b> ISO 10438-3 systems require shutdown for maintenance of instrumentation unless optional redundant instrumentation is provided.</p>                                       | Instrumentation and electrical systems shall be designed and fabricated according to Project specifications requirements. |
| <b>7. Inspection, testing, and preparation for shipment</b>                                                                                                                                                                                                                                                                                             |                                                                                                                           |
| <b>7.1 General</b>                                                                                                                                                                                                                                                                                                                                      |                                                                                                                           |
| <ul style="list-style-type: none"> <li>• If specified, the purchaser's or the Vendor's representative shall indicate compliance in accordance with the inspector's checklist (Annex C) by initialling, dating and submitting the completed checklist to the purchaser before shipment.</li> </ul>                                                       | This paragraph is applicable.                                                                                             |
| <b>7.3 Testing</b>                                                                                                                                                                                                                                                                                                                                      |                                                                                                                           |
| <b>7.3.1 General</b>                                                                                                                                                                                                                                                                                                                                    |                                                                                                                           |
| <ul style="list-style-type: none"> <li>• <b>7.3.1.2</b> The purchaser shall specify whether the purchased oil system is used during the shop testing of the equipment.</li> </ul>                                                                                                                                                                       | See comments to <a href="#">ISO 10438-2</a> paragraph 7.3.1.2.                                                            |
| <ul style="list-style-type: none"> <li>• <b>7.3.1.3</b> Complete-unit tests or other tests of the oil system and the equipment it serves shall be performed in place of or in addition to separate tests of the oil system as specified by the purchaser. Details of these tests shall be developed jointly by the purchaser and the Vendor.</li> </ul> | See comments to <a href="#">ISO 10438-2</a> paragraph 7.3.1.3.                                                            |
| <ul style="list-style-type: none"> <li>• <b>7.3.1.4</b> If specified, the Vendor, by bolting and unbolting piping, shall demonstrate that the pump on its baseplate is in compliance with 4.5.18 b).</li> </ul>                                                                                                                                         | This paragraph is applicable.                                                                                             |
| <b>8. Vendor's data</b>                                                                                                                                                                                                                                                                                                                                 |                                                                                                                           |
| <b>8.1 General</b>                                                                                                                                                                                                                                                                                                                                      |                                                                                                                           |
| <ul style="list-style-type: none"> <li>• If specified, a coordination meeting shall be held, within 4 to 6 weeks after order</li> </ul>                                                                                                                                                                                                                 | This paragraph is applicable.                                                                                             |



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| <b>General Specification</b>                                                                                     |                         | <b>GS EP MEC 281</b> |
| Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries<br>according to ISO 10438 / API Standard 614 |                         |                      |
| Rev.: 10                                                                                                         | Effective date: 10/2012 | Page: 68 of 111      |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | GS |
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| <p>commitment. Unless otherwise specified, the Vendor shall prepare and distribute an agenda prior to this meeting, which, as a minimum, shall include review of the following items:</p> <ul style="list-style-type: none"> <li>a) Purchase order, scope of supply, unit responsibility, Sub-Vendor items and lines of communication</li> <li>b) Datasheets</li> <li>c) Applicable specifications and previously agreed exceptions</li> <li>d) Schedules for transmittal of data, production and testing</li> <li>e) Quality assurance program and procedures</li> <li>f) Inspection, expediting and testing</li> <li>g) Schemas and bills of material</li> <li>h) Physical orientation of the equipment and piping in the auxiliary systems, including access for operation and maintenance</li> <li>i) Plot plan and equipment layout</li> <li>j) Other technical items.</li> </ul> |    |



| General Specification                                                                                            |                         | GS EP MEC 281   |
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| Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries<br>according to ISO 10438 / API Standard 614 |                         |                 |
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## **Annex C (informative)**

### **Inspector's checklist**

The Vendor's representative will indicate compliance in accordance with the inspector's checklist (Appendix C) by initialling, dating, and submitting the completed checklist to the purchaser prior to shipment.

## 6. Comments to ISO 10438-4/API Std 614

### Part 4 - Self-acting gas seal support systems

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| <b>4. General</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>4.1 System selection</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li>Datasheets for system specifications are provided in Appendix B.</li> </ul> <p>Annex B provides schemas of typical system components and diagrams of typical, complete dry gas seal support systems and modules. These schemas and diagrams illustrate the general philosophy and requirements of this part of ISO 10438 and are included to assist the purchaser in the selection of an appropriate system. The purchaser and the Vendor shall mutually agree upon an acceptable system.</p> <p>Annex C provides an inspector checklist of typical items reviewed by the purchaser.</p> | <ul style="list-style-type: none"> <li>Tandem dry gas seals with intermediate labyrinth with associated Company typical P&amp;ID's shall be selected. See Annex B figure B2 and Annex D figure D4.</li> </ul> <p>Compressor Manufacturer shall be fully responsible for the selection of the dry gas seals as per Company Vendor list and all associated components for logic, control and detection of malfunctions.</p> <p>Tertiary seal shall be labyrinth type.</p> <p>The Vendor's representative shall indicate compliance in accordance with the inspector's checklist (API 614 Annex C) by initialling, dating, and submitting the completed checklist to the purchaser prior to shipment.</p> |
| <b>4.2 Basic Design</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li><b>4.2.2</b> If specified, the purchaser may specify the Vendor responsible for each portion of the design, scope of supply, installation and performance of the dry gas seal system. If the purchaser is not the end user, then the end user shall approve the Vendors specified.</li> </ul>                                                                                                                                                                                                                                                                                            | <p>Refer to the following paragraphs which shall detail the minimum mandatory purchaser requirements.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <ul style="list-style-type: none"> <li><b>4.2.3</b> The purchaser shall specify the equipment's normal operating point and all other operating points. Other parameters required for the design of the seal support system, such as gas composition, maximum and minimum flare pressure, maximum and minimum sealing pressure and settle-out pressure shall also be specified.</li> </ul>                                                                                                                                                                                                                                       | <p>Compressors operating points are specified on Company Project data sheet.</p> <p>Vendor shall also consider the complete compressor performance map (not only the specified points) to design the seal gas system.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| <p><b>4.2.5</b> The dry gas seal system shall be designed to serve the full range of equipment operating conditions specified. These conditions may include but are not limited to the following:</p> <ul style="list-style-type: none"> <li>a) Settle-out pressures</li> <li>b) Process relief-valve settings</li> <li>c) Shop test and field run-ins</li> <li>d) Start-up conditions</li> <li>e) Gas composition.</li> </ul> <p><b>Note:</b> This requires a detailed system review with the equipment Suppliers, purchaser and Owner, and is normally finalized at the coordination meeting.</p> | <p>Dry gas seals shall be designed to operate with the following gas:</p> <ul style="list-style-type: none"> <li>• Gas composition as specified in the Project data sheets</li> <li>• Gas composition as required during the performance &amp; mechanical test and complete unit full load tests and defined by Supplier</li> <li>• Nitrogen or air during commissioning with maximum and minimum sealing pressures.</li> <li>• In normal operation: compressor suction maximum operating pressure, and PSV setting</li> <li>• At rest pressurized: settle out pressure</li> <li>• During starting sequence: settle out pressure.</li> </ul> <p>However, the dry gas seals shall be designed to be statically operated at the compressor discharge relief valve pressure.</p> <p>e) Process gas composition is not showing fraction parts of additives, however as specified on compressor data sheets and/or project basis of requirements, methanol can be injected upstream and downstream compression trains to avoid hydrate formation. When water fractions are shown on gas composition, a dehydration package running on tri-ethylene-glycol medium is generally included between two compression stages.</p> <p>Vendor has thus to design the DGS system materials considering this process arrangement.</p> |
| <p><b>4.2.7</b> All gas streams (including alternate, backup, start-up sources) into the seal shall be provided at a temperature of at least 20 K (35°R) above their dew point in order to preclude the possibility of liquid entering the dry gas seal.</p> <p><b>Note 1:</b> On some systems, the discharge temperature of the compressor gas Stream might not provide this dew-point margin.</p>                                                                                                                                                                                                 | <p>In any possible operating cases, the seal gas shall be filtered and heated considering the following requirement:</p> <ul style="list-style-type: none"> <li>• A minimum margin of 20 °C shall be maintained between the seal gas expansion curve and the seal gas dew point curve.</li> </ul> <p>The cases to be considered for this analysis shall be, as a minimum, the following:</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

| ISO / API                                                                                                                                                                                                                                                                                                                    | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| <p><b>Note 2:</b> In some cases, this can require heaters and/or heat tracing by the Owner.</p> <p>The dew-point margin shall be maintained throughout the seal and not just at the supply connections.</p> <p>In some cases, alternate gases to the process gas should be considered for start-up or dew-point reasons.</p> | <p>a) Pressurization, start-up and acceleration.</p> <p>b) Normal operation including but not limited to all the specified operating points and more generally within the operating envelope limits defined by the right and left limits at Maximum Continuous Speed and Minimum Operating Speed.</p> <p>c) Extended pressurized shut down.</p> <p>d) Depressurized shut down.</p> <p>Vendor shall provide a dedicated document detailing the seal gas dew point analysis for all the aforementioned conditions. This document shall include, as a minimum, the following information superimposed on a unique Pressure versus Temperature diagram:</p> <ul style="list-style-type: none"> <li>Seal gas (process gas or external source) dew point curve.</li> <li>Seal gas (process gas or external source) limit curve obtained from the dew point curve plus 20 °C margin.</li> <li>Seal gas conditions (pressure and temperature) at seal gas system inlet.</li> <li>Seal gas expansion curve from seal gas inlet conditions to atmospheric conditions. An isenthalpic expansion shall be considered to calculate this curve.</li> </ul> <p>Other unique diagrams shall be supplied for each different seal gas composition. All these unique diagrams including the aforementioned information shall be included in the technical proposal.</p> <p>The resulting seal gas supply design shall be fully detailed in the Vendor technical offer and shall conform to the attached schematic in Appendix A, as a minimum.</p> <p>Each compressor casing, when multiple casings are part of the shaft line, shall have its dedicated vent pipe routed to safe area and terminated with a flame arrestor to be provided by Vendor.</p> |
| <ul style="list-style-type: none"> <li><b>4.2.8</b> If specified, additional provision for seal-gas conditioning as specified by the purchaser shall be furnished.</li> </ul>                                                                                                                                                | <p>Pressure amplification system (Seal Gas Booster) shall be supplied by Vendor.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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| ISO / API                                                                                                                           | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
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| <p><b>Note:</b> Gas conditioning can involve heat tracing, alternate seal-gas sources, coalescing filters, or other provisions.</p> | <p>For sour gas applications containing H<sub>2</sub>S, Vendor shall indicate the required minimum nitrogen quality to prevent sulphur formation in any transient and operating conditions.</p> <p>Seal Gas Conditioning System Features (Refer to appendix A):</p> <p>1. Primary Seal Gas Feed line:</p> <ul style="list-style-type: none"> <li>• The primary seal gas feed line shall be heat traced and insulated from the compressor casing or from the external source tie-in point down to the dry gas seals housings.</li> <li>• External seal gas tie-in supply, flanged at skid edge. If an external source of seal gas is used, Company to provide external seal gas pressure at no more than the maximum working pressure of the compressor casing.</li> <li>• Single seal gas scrubber with coalescer filter equipped with level control, high alarm threshold function.</li> <li>• Seal gas duplex particles filters, with efficiency required by the DGS Vendor with manual operated change over valve while in operation. Filters shall be fitted with interlock system preventing from isolating the cartridge while it is active.</li> <li>• Single type arrangement pressure amplifier mounted on the main equipment baseframe.</li> <li>• Single seal gas ATEX certified heater fitted with thyristor control device and temperature controller located as close as possible downstream the heater. On/Off heater control is not allowed.</li> <li>• Alarm function: Low Temperature (TAL) set at control temperature minus 5°C shall initiate an alarm.</li> <li>• Shutdown function: Low Low Temperature (TSLL) set at control temperature minus 10°C shall initiate a depressurized shutdown.</li> </ul> |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>2. Buffer seal gas feed line:</b></p> <ul style="list-style-type: none"> <li>• Buffer gas tie-in supply, flanged at skid edge</li> <li>• Buffer gas duplex particles filters, with efficiency required by the DGS Vendor, with manual operated change over valve while in operation.</li> </ul> <p><b>3. Tertiary seal separation gas feed line:</b></p> <ul style="list-style-type: none"> <li>• Separation gas tie-in supply, flanged at skid edge.</li> <li>• Necessary instrumentation devices and associated signals and control as per PID attached in Appendix A.</li> <li>• Necessary flame arresters for atmospheric vent as per PID attached in Appendix A.</li> <li>• Necessary isolation devices for maintenance purpose as per PID attached in Appendix A.</li> </ul> |
| <ul style="list-style-type: none"> <li>• <b>4.2.11</b> The purchaser shall specify when and where double block and bleed valves are required for isolating a component and how they are arranged.</li> </ul> <p><b>Note:</b> Double block valves are normally provided where there are safety or environmental issues associated with the reliability of a single block valve.</p>                                                                                                                                                              | <p>The Vendor shall be fully responsible to deliver equipment safe for operation and maintenance.</p> <p>Double block and bleed valves shall be installed as shown in Appendix A, following these 3 configurations :</p> <ol style="list-style-type: none"> <li>1. Sweet (Non toxic) gas for operating pressure &lt; 70 bar(g).</li> <li>2. Sweet (Non toxic) gas for operating pressure &gt; 70 bar(g).</li> <li>3. Sour (toxic) gas.</li> </ol>                                                                                                                                                                                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li>• <b>4.2.12</b> Filters, drain traps and other pressure vessels shall be in accordance with the specified pressure design code. The purchaser shall specify if it is necessary that the vessels be code stamped.</li> </ul> <p><b>Note 1:</b> Most vessels for the gas seal module are smaller than the size required for the ASME code stamp.</p> <p><b>Note 2:</b> Code stamping might not be applicable for pressure design codes other than ASME.</p> <p><b>Note 3:</b> Reference can be made to</p> | <p><b>ASME Section VIII</b> is applicable; refer to Project specification for code stamp requirement.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | GS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| ISO 10438-1:2007, 4.5.7. Local jurisdictions can require a code stamp.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <ul style="list-style-type: none"> <li><b>4.2.14</b> The Vendor shall advise the purchaser of, and both parties shall mutually agree upon, any special provisions that are necessary to ensure that an adequate backup supply of seal gas and seal buffer gas or seal separation gas is maintained in the event of complete loss of the main seal-gas supply source. These provisions may include alternate seal-gas supply sources, backup gas bottles and special arrangements for start-up, purge gas and settle-out conditions. Provisions shall be adequate for block-in vent or purge situations as applicable. The purchaser shall specify the required block-in time. The purchaser and the Vendor shall mutually agree upon the backup system and its component requirements.</li> </ul> | <p>This paragraph is applicable.</p> <p><b>Clarification &amp; Addition</b></p> <p>Vendor shall provide a drain with float trap or sight glass with manual drain valve between secondary and tertiary seals for oil leaks detection. Valve can only be opened to drain the cavity while the compressor is stopped and depressurized. Refer to Appendix A.</p> <p>In case of gas turbine driven compressors, Vendor shall insure that the DC lube oil pump shall not supply the compressor bearings.</p>                                                                                    |
| <p><b>4.2.17</b> Dry-gas-seal system piping size and vents shall be sized to prevent over-pressurization of the bearing housings in the event of a failure of the seal.</p> <p>This is a system requirement, which should be coordinated between the equipment Supplier (seal housing connection sizes), dry-gas-seal system module designer (vent-piping sizes) and the installation designer (vent sizes and piping lengths).</p>                                                                                                                                                                                                                                                                                                                                                               | <p><b>Clarification</b></p> <p>Refer to Appendix A.</p> <p>Buffer gas feed line shall be sized with the rating of the compressor suction line design pressure from separation 1 down to the compressor connection flange.</p> <p>Vents to flare shall be sized with the same rating of the compressor suction line design pressure down to separation 2 as shown on PID in Appendix A, in order to keep full integrity of the seal system in case of seal failure.</p> <p>Vent line shall be sized with the same rating of the compressor casing design pressure down to separation 3.</p> |
| <p><b>4.3.1.1</b> The filters shall have a minimum efficiency of 98.8% on particles less than or equal to 4 µm (beta ratio, B4 &lt; 85) and shall be in accordance with the dry gas seals Manufacturer's requirements.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p><b>Clarification</b></p> <p>Filtration efficiency as required by the DGS Vendor.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>4.4 Transfer valves</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <p><b>4.4.2</b> Transfer valves shall have steel bodies. Valve stems, plugs or balls shall be made of</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <p><b>Modification</b></p> <p>Transfer valves shall be 316 stainless steel</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

| ISO / API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | GS                                                                                                                                                                                                                     |
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| stainless steel.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | minimum grade, bodies included. The transfer valves shall be tight shutoff type and provided with integral strainer. Zero leakage (bubble tight) transfer valves are mandatory.                                        |
| <b>5. Piping and tubing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                        |
| <p><b>5.1</b> The Vendor shall furnish the dry-gas-seal module, including mounted appurtenances, located within the confines of the base area. All connections on the module for interconnecting piping to the equipment shall be flanged. Module interface Ranges connected to tubing shall be supported from the module structure.</p> <p><b>Note:</b> All mounted appurtenances are kept within the confines of the base area to keep work areas and walkways as free as possible from obstructions and to protect tubing from damage. Externally supported, flanged exit connections on tubing are used to protect the tubing from external loads.</p> <p>The interconnecting system between the module and equipment should be rigid pipe. The interconnecting system is provided by the Vendor as defined in the datasheets. Piping and tubing shall be austenitic stainless steel and shall be in accordance with ISO 10438-1:2007, Tables 1, 5 and 6 unless otherwise specified.</p> | <p><b>Modification</b></p> <p>All piping shall be in accordance with here above commented <a href="#">ISO 10438-1:2007</a>, Clause 5, including additional comments in 5.1.2 and 5.1.3. Refer to Part 1, clause 5.</p> |
| <p><b>5.2</b> Unless otherwise specified, dry-gas-seal modules designed for working pressures (gauge) below 6200 kPa (62 bar; 900 psi) shall have the gas flow lines manufactured from stainless steel tubing or stainless steel piping.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>Clarification</b></p> <p>Dry-gas-seal modules designed for working pressures (gauge) below 6200 kPa (62 bar; 900 psi) shall have the gas flow lines manufactured from 316L stainless steel piping.</p>           |
| <p><b>5.3</b> Unless otherwise specified, dry-gas-seal modules with working pressures (gauge) greater than 6200 kPa (62 bar; 900 psi) shall have gas flow lines manufactured from stainless steel piping.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p><b>Clarification</b></p> <p>Dry-gas-seal modules with working pressures (gauge) greater than 6200 kPa (62 bar; 900 psi) shall have gas flow lines manufactured from 316L stainless steel piping.</p>                |
| <p><b>5.4</b> Instrument valves within the dry-gas-seal module on tubing lines shall be tubing valves.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p><b>Clarification</b></p> <p>Instrument valves within the dry-gas-seal</p>                                                                                                                                           |

| ISO / API                                                                                                                                                                                                                                                                           | GS                                                                                                                                                                                                                                         |
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|                                                                                                                                                                                                                                                                                     | module shall be made of 316 stainless steel and shall be provided with vent, drain and test ports.                                                                                                                                         |
| <b>5.5</b> Control valves shall have steel bodies and stainless steel trim. Where practical, valves shall be removable without removing piping or tubing.<br><b>Note:</b> Smaller valves can have threaded connections that require fittings to be disconnected.                    | <b>Modification</b><br>Control valves shall be 316 stainless steel minimum grade, bodies included and shall be provided with flanges at both ends.                                                                                         |
| <b>5.6</b> Threaded connections in toxic and flammable service shall be used only as approved by the purchaser.<br><b>Note:</b> Small component size can dictate the use of threaded components. Seal welding is an acceptable alternative but results in maintenance implications. | <b>Clarification</b><br>Threaded connections in toxic and flammable service shall not be used.                                                                                                                                             |
| <b>6. Instrumentation, control, and electrical systems</b>                                                                                                                                                                                                                          |                                                                                                                                                                                                                                            |
| <b>6.2 Alarms and shutdowns</b>                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                            |
| <b>6.2.1</b> Unless otherwise specified, the Vendor shall furnish and mount, as a minimum, the primary alarm and shutdown contacts specified in Table 1.                                                                                                                            | <b>Addition</b><br>In addition to Table 1, refer to Company typical PI&D's in Appendix A.                                                                                                                                                  |
| <ul style="list-style-type: none"> <li><b>6.2.2</b> Pressure or flow control and sensing shall be as specified or as mutually agreed.</li> </ul>                                                                                                                                    | <b>Addition &amp; Clarification.</b><br>Pressure control devices (Pressure Control Valve) shall be provided on each primary vent line in order to maintain permanent positive pressure at primary seals whatever the transient conditions. |
| <ul style="list-style-type: none"> <li><b>6.2.3</b> The purchaser shall specify shutdown and alarms in accordance with one of the three arrangements detailed in ISO 10438-1:2007, 6.2.3.</li> </ul>                                                                                | Refer to Part 1 paragraph 6, in 6.2.3 and 6.2.3.3 including additional comments.                                                                                                                                                           |
| <b>6.3 Instrumentation</b>                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                            |
| <b>6.3.1 Flow Indicators</b>                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                            |
| <ul style="list-style-type: none"> <li><b>6.3.1.2</b> If specified, turbine flow transmitters shall be supplied.</li> </ul>                                                                                                                                                         | <b>Clarification</b><br>Flow measurement devices shall be orifice plates coupled with delta pressure transmitters and shall be supplied by the                                                                                             |

| ISO / API                                                                                                                                                                                                                                                                                                               | GS                                                                                                                                                                                                                                                                                                      |
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|                                                                                                                                                                                                                                                                                                                         | Vendor.                                                                                                                                                                                                                                                                                                 |
| <b>6.3.1.3</b> Unless otherwise specified, flow meters in inert separation-gas services may be of the plastic rotameter design.                                                                                                                                                                                         | <b>Clarification</b><br>Rotameter type flow meters are not accepted whatever the gas services measured.                                                                                                                                                                                                 |
| <ul style="list-style-type: none"> <li><b>6.3.1.4</b> If specified, seal-gas flow measurement shall be by an electronic device such as a linear mass flow meter, venturi or turbine type. The purchaser shall specify whether the readout device is supplied by the module Manufacturer or by the purchaser.</li> </ul> | <b>Clarification</b><br>Seal gas flow measurement is not required.                                                                                                                                                                                                                                      |
| <b>6.3.2 Relief valves</b>                                                                                                                                                                                                                                                                                              | <b>Modification</b><br>Relief valves are not accepted; design of vessels, piping and tubing shall match the worst operating or stand still conditions of the clause 4.2.5. Vessels, piping and tubing design pressure shall be equal to the compressor casing design pressure as a minimum requirement. |
| <b>6.3.3 Rupture disks</b>                                                                                                                                                                                                                                                                                              | <b>Modification</b><br>Rupture disks are not accepted.                                                                                                                                                                                                                                                  |
| <b>7. Inspection, testing, and preparation for shipment</b>                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                         |
| <b>7.1 General</b>                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                         |
| <ul style="list-style-type: none"> <li><b>7.1.2</b> If specified, the purchaser's or the Vendor's representative or both shall indicate compliance in accordance with the inspector's checklist (Annex C) by initialling, dating and submitting the completed checklist to the purchaser prior to shipment.</li> </ul>  | This paragraph is applicable.                                                                                                                                                                                                                                                                           |
| <b>7.3 Testing</b>                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                         |
| <b>7.3.1 General</b>                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                         |
| <ul style="list-style-type: none"> <li><b>7.3.1.2</b> If specified, the dry-gas-seal module shall be used during the main equipment's mechanical run test.</li> </ul>                                                                                                                                                   | This paragraph is not applicable.<br>However, the dry gas seal panel shall be used during the packages string tests                                                                                                                                                                                     |
| <b>Operational tests</b>                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                         |
| <ul style="list-style-type: none"> <li><b>7.3.3.4</b> If specified, a functional test proposed by the Vendor and agreed to by the purchaser of the dry-seal gas module shall be performed at the Vendor's shop.</li> </ul>                                                                                              | This paragraph is not applicable.                                                                                                                                                                                                                                                                       |

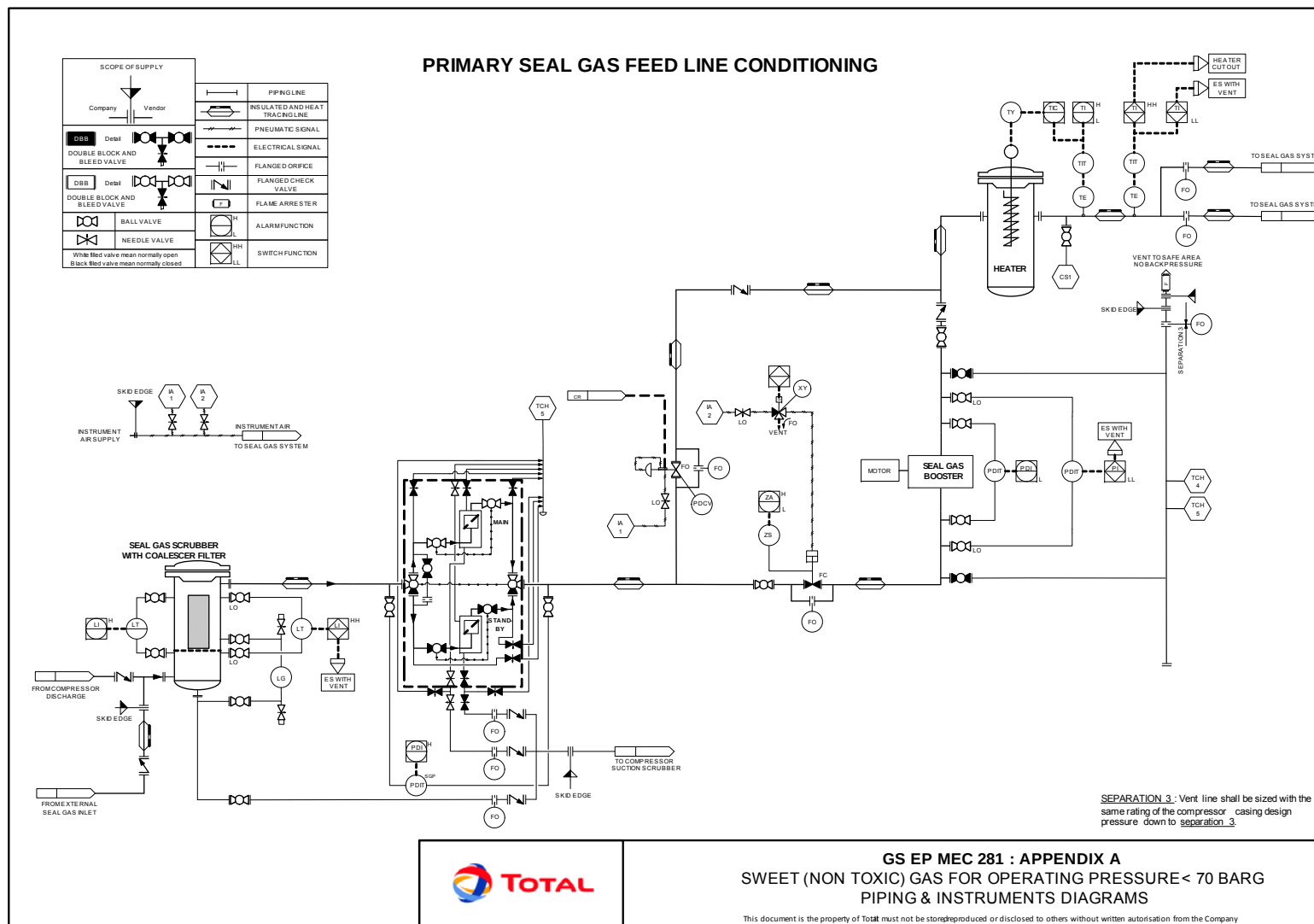


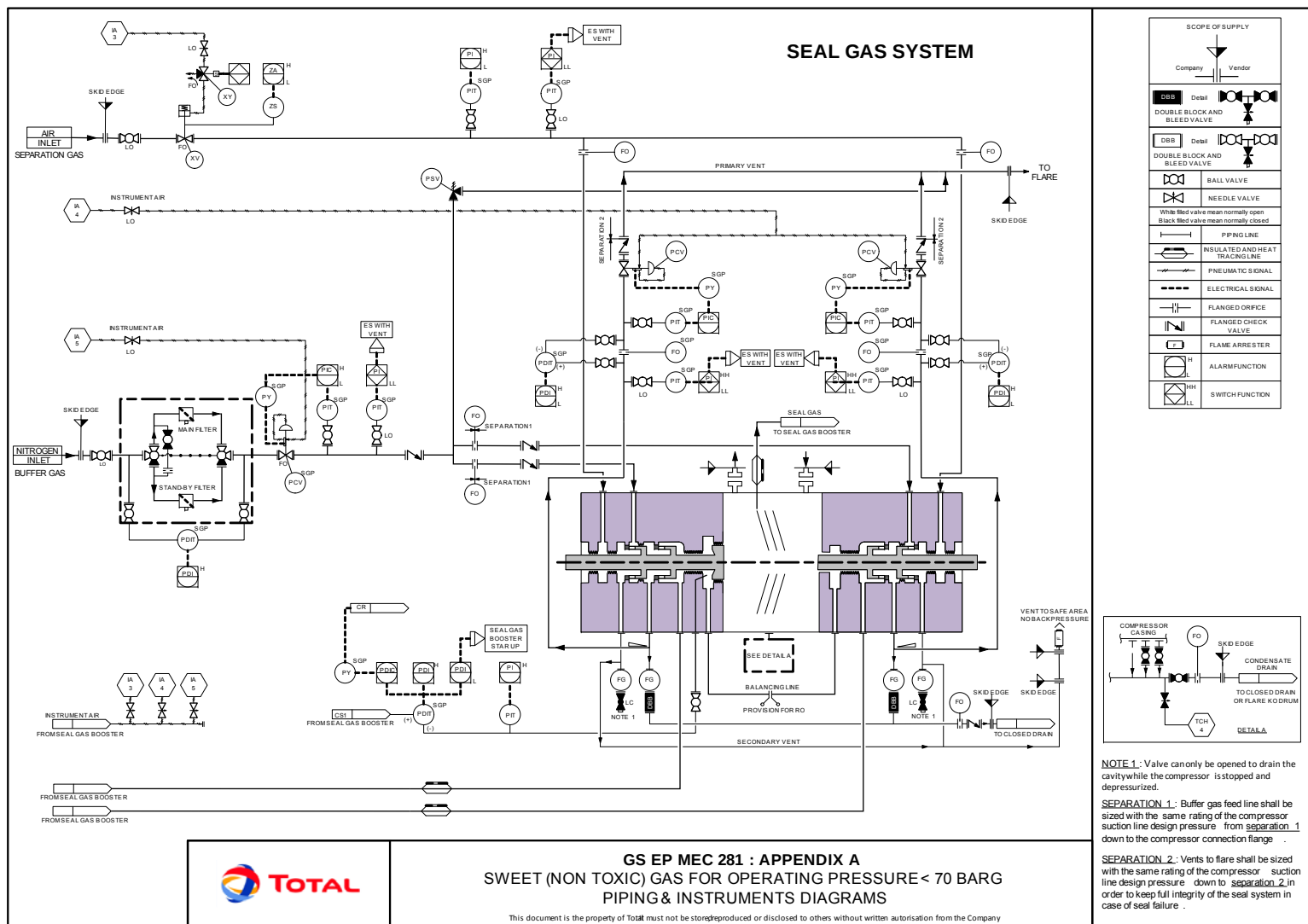
| General Specification                                                                                         |                         | GS EP MEC 281   |
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| Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries according to ISO 10438 / API Standard 614 |                         |                 |
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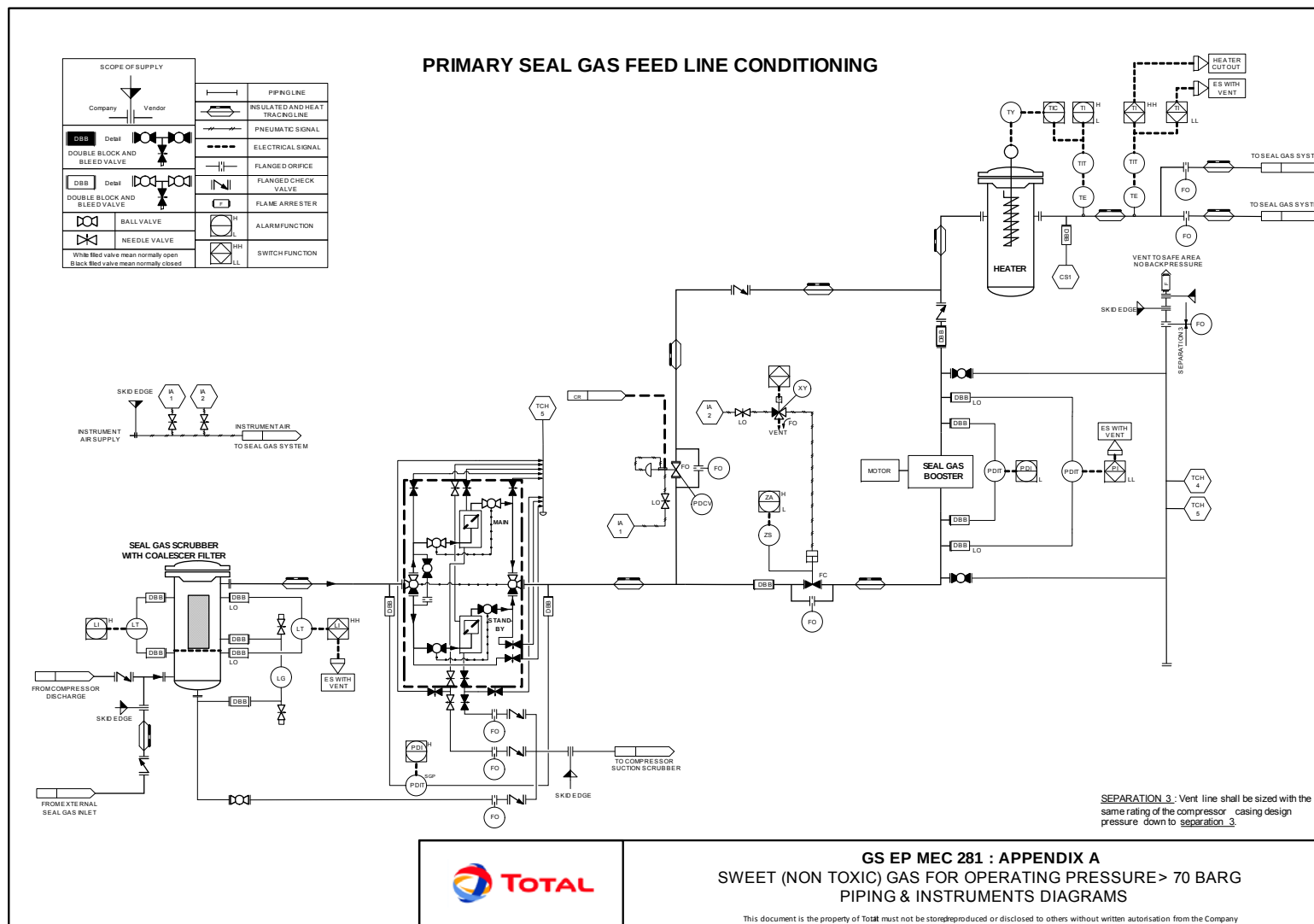
## **Appendix A**

### **Company Typical Piping & Instruments Diagrams for the Primary Seal Gas Feed Line Conditioning and the Seal Gas System**

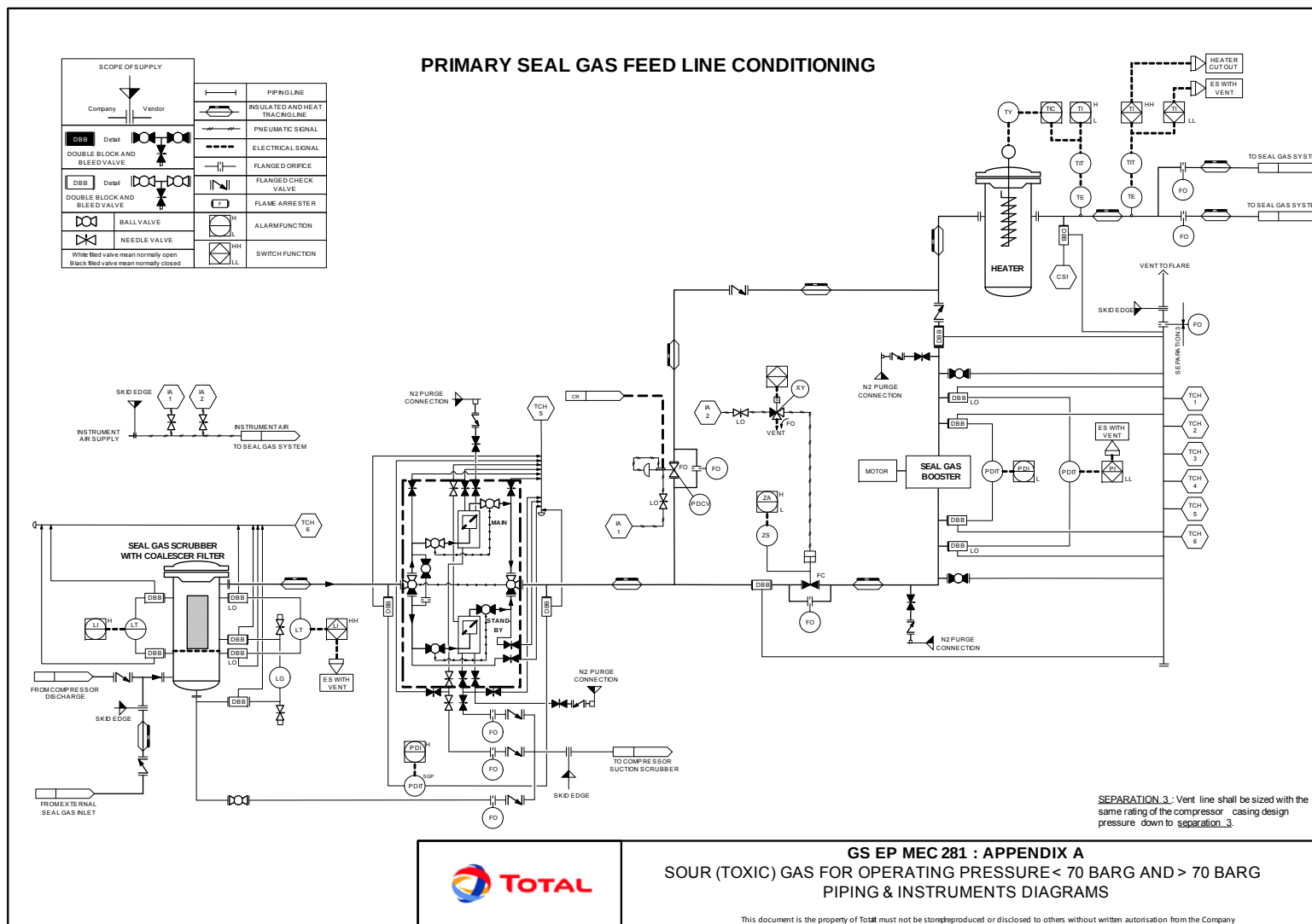
- SWEET (NON TOXIC) GAS FOR OPERATING PRESSURE < 70 BARG
- SWEET (NON TOXIC) GAS FOR OPERATING PRESSURE > 70 BARG
- SOUR (TOXIC) GAS FOR OPERATING PRESSURE < 70 BARG AND > 70 BARG

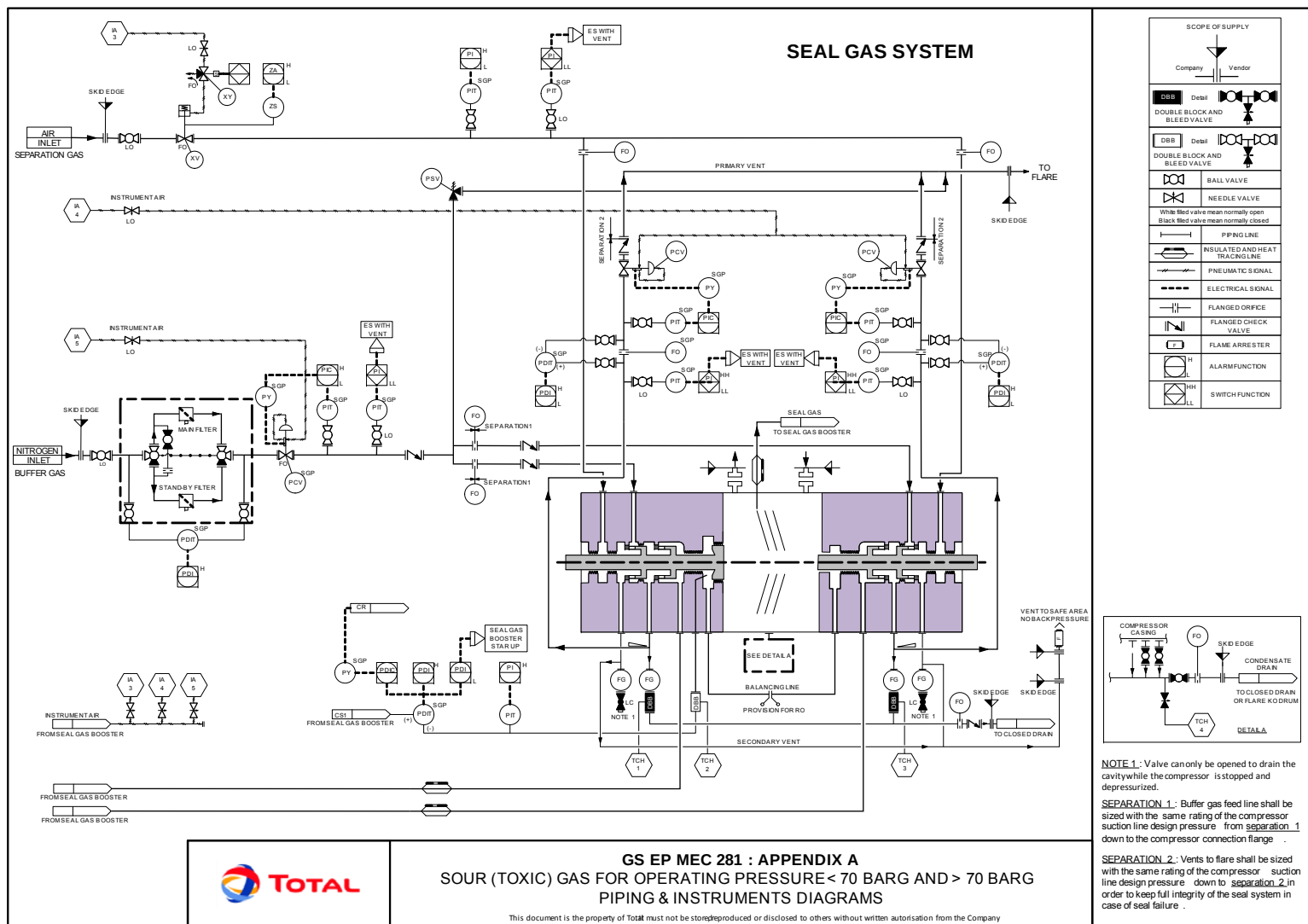














| General Specification                                                                                         |                         | GS EP MEC 281   |
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| Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries according to ISO 10438 / API Standard 614 |                         |                 |
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## Appendix B

|                                                                                                                                                                                                                                                                                                                          |                                                                                  |
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| <p>This annex contains the datasheets in both SI and USC units, together with an explanatory note.</p> <p>The options for units are as follows:</p> <ul style="list-style-type: none"><li>• USC units</li><li>• SI units (MPa)</li><li>• SI units (kPa)</li><li>• Metric (kg/cm<sup>2</sup>)</li><li>• Hybrid.</li></ul> | <p><b>Clarification</b></p> <p>The SI units (kPa) data sheets shall be used.</p> |
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| General Specification                                                                                            |                         | GS EP MEC 281   |
|------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------|
| Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries<br>according to ISO 10438 / API Standard 614 |                         |                 |
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## Datasheet **ISO 10438-1**



## General Specification

**GS EP MEC 281**

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according to ISO 10438 / API Standard 614

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|                                                                                                                     |                                                                                                                                                                      | DATA SHEET                        |                                   |                                                    |               |                 |
|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------|----------------------------------------------------|---------------|-----------------|
|                                                                                                                     |                                                                                                                                                                      | Main Project Title                |                                   |                                                    |               |                 |
|                                                                                                                     |                                                                                                                                                                      |                                   |                                   |                                                    | Page          | 1 of 6          |
| Issuing Dpt                                                                                                         | Rev. / Date                                                                                                                                                          | 1/                                | 2/                                | 3/                                                 | 4/            | 5/              |
| Written by :                                                                                                        |                                                                                                                                                                      |                                   |                                   |                                                    |               |                 |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO <b>ISO 10438-1 / API STD 614</b> |                                                                                                                                                                      |                                   |                                   |                                                    | DS EP MEC 281 |                 |
| Annex A - Data Sheets                                                                                               |                                                                                                                                                                      |                                   |                                   |                                                    |               |                 |
| Table A1 - Data sheet scope and attachments - SI units                                                              |                                                                                                                                                                      |                                   |                                   |                                                    |               |                 |
| Job No.:                                                                                                            |                                                                                                                                                                      |                                   |                                   | Item No.:                                          |               |                 |
| 1                                                                                                                   | Apply to                                                                                                                                                             | <input type="checkbox"/> Proposal | <input type="checkbox"/> Purchase | <input type="checkbox"/> As built                  |               |                 |
| 2                                                                                                                   | For                                                                                                                                                                  |                                   |                                   |                                                    | Site          |                 |
| 3                                                                                                                   | Oil system for                                                                                                                                                       |                                   |                                   |                                                    |               |                 |
| 4                                                                                                                   | Supplier                                                                                                                                                             |                                   |                                   |                                                    | Manufacturer  |                 |
| 5                                                                                                                   | Purchase order No.                                                                                                                                                   |                                   | Date                              |                                                    | Inquiry No.   | Requisition No. |
| 6                                                                                                                   |                                                                                                                                                                      |                                   |                                   |                                                    |               |                 |
| 7                                                                                                                   | Explanations:                                                                                                                                                        |                                   |                                   |                                                    |               |                 |
| 8                                                                                                                   | - The party to complete the information is indicated as follow s:                                                                                                    |                                   |                                   |                                                    |               |                 |
| 9                                                                                                                   | <input type="radio"/> Purchaser <input type="checkbox"/> Vendor <input type="checkbox"/> Either, but by vendor if not by purchaser                                   |                                   |                                   |                                                    |               |                 |
| 10                                                                                                                  | - An asterisk * specifies a requirement, value or criterion.                                                                                                         |                                   |                                   |                                                    |               |                 |
| 11                                                                                                                  | - Designations in parentheses ( ) are: explained in the cited standard; those prefixed "T" are text figure numbers; those prefixed "A" are Annex "A" figure numbers. |                                   |                                   |                                                    |               |                 |
| 12                                                                                                                  |                                                                                                                                                                      |                                   |                                   |                                                    |               |                 |
| 13                                                                                                                  | Applicable documents:                                                                                                                                                |                                   |                                   |                                                    |               |                 |
| 14                                                                                                                  | <input type="radio"/> Local instruments and panel items (ISO 10438-1)                                                                                                |                                   |                                   |                                                    |               |                 |
| 15                                                                                                                  | <input type="radio"/> Instrument suppliers (ISO 10438-1)                                                                                                             |                                   |                                   |                                                    |               |                 |
| 16                                                                                                                  | <input type="radio"/> Special-purpose oil systems (ISO 10438-2)                                                                                                      |                                   |                                   |                                                    |               |                 |
| 17                                                                                                                  | <input type="radio"/> General-purpose oil systems (ISO 10438-3)                                                                                                      |                                   |                                   |                                                    |               |                 |
| 18                                                                                                                  | <input type="radio"/> Self-acting gas seal support modules (ISO 10438-4)                                                                                             |                                   |                                   |                                                    |               |                 |
| 19                                                                                                                  | <input type="radio"/> Additional documents                                                                                                                           |                                   |                                   |                                                    |               |                 |
| 20                                                                                                                  | <input type="radio"/> Additional documents                                                                                                                           |                                   |                                   |                                                    |               |                 |
| 21                                                                                                                  |                                                                                                                                                                      |                                   |                                   |                                                    |               |                 |
| 22                                                                                                                  | Installation data: (also see page 2)                                                                                                                                 |                                   |                                   |                                                    |               |                 |
| 23                                                                                                                  | <input type="radio"/> * General site data included in specification                                                                                                  |                                   |                                   |                                                    |               |                 |
| 24                                                                                                                  | <input type="radio"/> * Utility data included in specification                                                                                                       |                                   |                                   |                                                    |               |                 |
| 25                                                                                                                  | * If blank, provide on page 2 of this specification                                                                                                                  |                                   |                                   |                                                    |               |                 |
| 26                                                                                                                  | Space available for oil system: L ( ) W ( ) H ( ) (m)                                                                                                                |                                   |                                   |                                                    |               |                 |
| 27                                                                                                                  | Plot plan showing console location in relation to main equipment: →                                                                                                  |                                   |                                   |                                                    |               |                 |
| 28                                                                                                                  | Maximum allowable noise level not to exceed ( ) dB or see ( )                                                                                                        |                                   |                                   |                                                    |               |                 |
| 29                                                                                                                  | (Sketch the equipment plot plan with relation to the console location here)                                                                                          |                                   |                                   |                                                    |               |                 |
| 30                                                                                                                  | <input type="radio"/> Winterize <input type="radio"/> Tropicalize <input type="radio"/> Minimum clearance and access to components required                          |                                   |                                   |                                                    |               |                 |
| 31                                                                                                                  | Area classification: Class ( ) Group ( ) Division ( ) or see ( )                                                                                                     |                                   |                                   |                                                    |               |                 |
| 32                                                                                                                  |                                                                                                                                                                      |                                   |                                   |                                                    |               |                 |
| 33                                                                                                                  | Equipment oil required:                                                                                                                                              |                                   |                                   |                                                    |               |                 |
| 34                                                                                                                  | Lube oil:                                                                                                                                                            |                                   |                                   |                                                    |               |                 |
| 35                                                                                                                  |                                                                                                                                                                      |                                   |                                   |                                                    |               |                 |
| 36                                                                                                                  | <input type="checkbox"/> kPa supply pressure                                                                                                                         | Normal                            | After trip                        |                                                    |               |                 |
| 37                                                                                                                  | <input type="checkbox"/> Driven equipment                                                                                                                            | m³/h                              | m³/h                              |                                                    |               |                 |
| 38                                                                                                                  | <input type="checkbox"/> Driven equipment                                                                                                                            |                                   |                                   |                                                    |               |                 |
| 39                                                                                                                  | <input type="checkbox"/> Driven equipment                                                                                                                            |                                   |                                   |                                                    |               |                 |
| 40                                                                                                                  | <input type="checkbox"/> Prime mover                                                                                                                                 |                                   |                                   |                                                    |               |                 |
| 41                                                                                                                  | <input type="checkbox"/> Gears                                                                                                                                       |                                   |                                   |                                                    |               |                 |
| 42                                                                                                                  | <input type="checkbox"/> Couplings                                                                                                                                   |                                   |                                   |                                                    |               |                 |
| 44                                                                                                                  | <input type="checkbox"/> Total:                                                                                                                                      |                                   |                                   |                                                    |               |                 |
| 46                                                                                                                  | <input type="checkbox"/> Control oil (normal)                                                                                                                        |                                   |                                   |                                                    |               |                 |
| 48                                                                                                                  | <input type="checkbox"/> Control oil (transient)                                                                                                                     |                                   |                                   |                                                    |               |                 |
| 49                                                                                                                  |                                                                                                                                                                      |                                   |                                   |                                                    |               |                 |
| 50                                                                                                                  |                                                                                                                                                                      |                                   |                                   |                                                    |               |                 |
|                                                                                                                     |                                                                                                                                                                      |                                   |                                   | Seal oil - Range of operating conditions           |               |                 |
|                                                                                                                     |                                                                                                                                                                      |                                   |                                   | Normal                                             | After trip    |                 |
|                                                                                                                     |                                                                                                                                                                      |                                   |                                   | low /pressur                                       | low /pressur  |                 |
|                                                                                                                     |                                                                                                                                                                      |                                   |                                   | m³/h Kpa                                           | m³/h Kpa      |                 |
|                                                                                                                     |                                                                                                                                                                      |                                   |                                   | <input type="radio"/> Normal operation             | /             | /               |
|                                                                                                                     |                                                                                                                                                                      |                                   |                                   | <input type="radio"/> Settling out pressure        | /             | /               |
|                                                                                                                     |                                                                                                                                                                      |                                   |                                   | <input type="radio"/> Process relief valve setting | /             | /               |
|                                                                                                                     |                                                                                                                                                                      |                                   |                                   | <input type="radio"/> Shop test and field run-in   | /             | /               |
|                                                                                                                     |                                                                                                                                                                      |                                   |                                   | <input type="radio"/> Startup                      | /             | /               |
|                                                                                                                     |                                                                                                                                                                      |                                   |                                   | <input type="radio"/> Other                        | /             | /               |
|                                                                                                                     |                                                                                                                                                                      |                                   |                                   | <input type="checkbox"/> Oil type and viscosity :  |               |                 |
|                                                                                                                     |                                                                                                                                                                      |                                   |                                   | <input type="checkbox"/> Required heat load:       | (kW)          |                 |

Column blank for revision number (X)

| COMPANY REFERENCES | SUPPLIER REFERENCES |
|--------------------|---------------------|
|                    | Company :           |
|                    | JOB N° :            |

|                                    |                                                            | DATA SHEET         |                                                          |                     |                                                                    |             |  |
|---------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|--------------------|----------------------------------------------------------|---------------------|--------------------------------------------------------------------|-------------|--|
|                                                                                                                     |                                                            | Main Project Title |                                                          |                     |                                                                    | Page 2 of 6 |  |
| Issuing Dpt                                                                                                         | Rev. / Date                                                | 1/                 | 2/                                                       | 3/                  | 4/                                                                 | 5/          |  |
| Written by :                                                                                                        |                                                            |                    |                                                          |                     |                                                                    |             |  |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO <b>ISO 10438-1 / API STD 614</b> |                                                            |                    |                                                          |                     | DS EP MEC 281                                                      |             |  |
| Annex A - Data Sheets                                                                                               |                                                            |                    |                                                          |                     |                                                                    |             |  |
| Table A1 - Data sheet scope and attachments - SI units (continued)                                                  |                                                            |                    |                                                          |                     |                                                                    |             |  |
|                                                                                                                     |                                                            | Job No.:           |                                                          | Item No.:           |                                                                    |             |  |
| 1                                                                                                                   | <b>*Site data:</b>                                         |                    | <b>Utility data</b>                                      |                     |                                                                    |             |  |
| 2                                                                                                                   | <input type="radio"/> Ambient conditions                   |                    | <input type="radio"/> Electrical                         |                     | <input type="radio"/> Cooling water: w water source                |             |  |
| 3                                                                                                                   | <input type="radio"/> Min/max temperature (°C) /           |                    | <input type="radio"/> Volts                              |                     | <input type="radio"/> Inlet temperature (°C) Maximum return (°C)   |             |  |
| 4                                                                                                                   | <input type="radio"/> Relative humidity                    |                    | <input type="radio"/> Hertz                              |                     | <input type="radio"/> Normal pressure (kPa) Normal pressure (kPa)  |             |  |
| 5                                                                                                                   |                                                            |                    | <input type="radio"/> Phase                              |                     | <input type="radio"/> Min. return (kPa) Maximum delta p (Δp) (kPa) |             |  |
| 6                                                                                                                   |                                                            |                    |                                                          |                     |                                                                    |             |  |
| 7                                                                                                                   |                                                            |                    |                                                          |                     |                                                                    |             |  |
| 8                                                                                                                   | <input type="radio"/> Steam                                |                    | <b>Drivers:</b>                                          |                     | <b>Heating</b>                                                     |             |  |
| 9                                                                                                                   | Inlet min. Pressure                                        |                    | Temperature                                              |                     | Pressure Temperature                                               |             |  |
| 10                                                                                                                  | Normal Pressure                                            |                    | Temperature                                              |                     | Pressure Temperature                                               |             |  |
| 11                                                                                                                  | Maximum Pressure                                           |                    | Temperature                                              |                     | Pressure Temperature                                               |             |  |
| 12                                                                                                                  | Exhaust min. Pressure                                      |                    | Temperature                                              |                     | Pressure Temperature                                               |             |  |
| 13                                                                                                                  | Normal Pressure                                            |                    | Temperature                                              |                     | Pressure Temperature                                               |             |  |
| 14                                                                                                                  | Maximum Pressure                                           |                    | Temperature                                              |                     | Pressure Temperature                                               |             |  |
| 15                                                                                                                  |                                                            |                    |                                                          |                     |                                                                    |             |  |
| 16                                                                                                                  | <b>Location:</b>                                           |                    |                                                          |                     |                                                                    |             |  |
| 17                                                                                                                  | <input type="radio"/> Indoor                               |                    | <input type="radio"/> Heated                             |                     | <input type="radio"/> Under roof                                   |             |  |
| 18                                                                                                                  | <input type="radio"/> Outdoor                              |                    | <input type="radio"/> Unheated                           |                     |                                                                    |             |  |
| 19                                                                                                                  | <b>Painting:</b>                                           |                    | <input type="checkbox"/> Masses (kg)                     |                     | <input type="checkbox"/> Dimensions (m) L W H                      |             |  |
| 20                                                                                                                  |                                                            |                    | Console                                                  |                     | Console                                                            |             |  |
| 21                                                                                                                  | <input type="radio"/> Component supplier standard          |                    | Panel                                                    |                     | Panel                                                              |             |  |
| 22                                                                                                                  | <input type="radio"/> Unified per system supplier standard |                    |                                                          |                     |                                                                    |             |  |
| 23                                                                                                                  | <input type="radio"/> Purchased standard per               |                    |                                                          |                     |                                                                    |             |  |
| 24                                                                                                                  | <input type="radio"/>                                      |                    |                                                          |                     |                                                                    |             |  |
| 25                                                                                                                  | <input type="radio"/>                                      |                    |                                                          |                     |                                                                    |             |  |
| 26                                                                                                                  | <b>Preparation for shipment:</b>                           |                    | <b>Miscellaneous documentation</b>                       |                     |                                                                    |             |  |
| 27                                                                                                                  | ● Install new filter elements and tag                      |                    | ● Spare parts quotation w with proposal                  |                     |                                                                    |             |  |
| 28                                                                                                                  | ● Include 3 sets of extra filter elements                  |                    | ● Spare parts quotation after contract                   |                     |                                                                    |             |  |
| 29                                                                                                                  | ● Box extra sets with the 3 system                         |                    | ● Above based on normal supply for 24 months             |                     |                                                                    |             |  |
| 30                                                                                                                  | <b>Other spares</b>                                        |                    | ● Complete inspector's checklist                         |                     |                                                                    |             |  |
| 31                                                                                                                  | <input type="radio"/>                                      |                    | ● Progress reports                                       |                     |                                                                    |             |  |
| 32                                                                                                                  | <input type="radio"/>                                      |                    | ● Technical data manual w within 30 days after shop test |                     |                                                                    |             |  |
| 33                                                                                                                  | <input type="radio"/>                                      |                    | <input type="radio"/>                                    |                     |                                                                    |             |  |
| 34                                                                                                                  | <input type="radio"/>                                      |                    | <input type="radio"/>                                    |                     |                                                                    |             |  |
| 35                                                                                                                  |                                                            |                    |                                                          |                     |                                                                    |             |  |
| 36                                                                                                                  | <b>System and components</b>                               |                    | <b>Spare parts</b>                                       |                     |                                                                    |             |  |
| 37                                                                                                                  |                                                            |                    | Vendor std.                                              |                     | Purch. spec.                                                       |             |  |
| 38                                                                                                                  | <input type="radio"/> Domestic                             |                    | <input type="checkbox"/>                                 |                     | <input type="checkbox"/>                                           |             |  |
| 39                                                                                                                  | ● Export                                                   |                    | <input type="checkbox"/>                                 |                     | <input type="checkbox"/>                                           |             |  |
| 40                                                                                                                  | ● Extended storage                                         |                    | <input type="checkbox"/>                                 |                     | <input type="checkbox"/>                                           |             |  |
| 41                                                                                                                  | 12 months                                                  |                    |                                                          |                     |                                                                    |             |  |
| 42                                                                                                                  |                                                            |                    |                                                          |                     |                                                                    |             |  |
| 43                                                                                                                  | <b>Comments:</b>                                           |                    |                                                          |                     |                                                                    |             |  |
| 44                                                                                                                  |                                                            |                    |                                                          |                     |                                                                    |             |  |
| 45                                                                                                                  |                                                            |                    |                                                          |                     |                                                                    |             |  |
| 46                                                                                                                  |                                                            |                    |                                                          |                     |                                                                    |             |  |
| 47                                                                                                                  |                                                            |                    |                                                          |                     |                                                                    |             |  |
| 48                                                                                                                  |                                                            |                    |                                                          |                     |                                                                    |             |  |
| 49                                                                                                                  |                                                            |                    |                                                          |                     |                                                                    |             |  |
| 50                                                                                                                  |                                                            |                    |                                                          |                     |                                                                    |             |  |
| 51                                                                                                                  |                                                            |                    |                                                          |                     |                                                                    |             |  |
| COMPANY REFERENCES                                                                                                  |                                                            |                    |                                                          | SUPPLIER REFERENCES |                                                                    |             |  |
|                                                                                                                     |                                                            |                    |                                                          | Company :           |                                                                    |             |  |
|                                                                                                                     |                                                            |                    |                                                          | JOB N° :            |                                                                    |             |  |

Column blank for revision number (X)



# General Specification

GS EP MEC 281

Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries according to ISO 10438 / API Standard 614

Rev.: 10

Effective date: 10/2012

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|                                                                                                           |                                                                                                                                                                                                                                | DATA SHEET                        |                                   |                                   |               |                 |
|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---------------|-----------------|
|                                                                                                           |                                                                                                                                                                                                                                | Main Project Title                |                                   |                                   | Page 3 of 6   |                 |
| Issuing Dpt                                                                                               | Rev. / Date                                                                                                                                                                                                                    | 1/                                | 2/                                | 3/                                | 4/            | 5/              |
| Written by :                                                                                              |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS AND AUXILIARIES ACCORDING TO ISO 10438-1 / API STD 614 |                                                                                                                                                                                                                                |                                   |                                   |                                   | DS EP MEC 281 |                 |
| Annex A - Data Sheets                                                                                     |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| Table A3 - Data sheet instrument suppliers                                                                |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| Job No.: Item No.:                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 1                                                                                                         | Applicable to                                                                                                                                                                                                                  | <input type="checkbox"/> Proposal | <input type="checkbox"/> Purchase | <input type="checkbox"/> As built | Site          |                 |
| 2                                                                                                         | For                                                                                                                                                                                                                            |                                   |                                   |                                   |               |                 |
| 3                                                                                                         | Oil system for                                                                                                                                                                                                                 |                                   |                                   |                                   |               |                 |
| 4                                                                                                         | Supplier                                                                                                                                                                                                                       |                                   |                                   |                                   | Manufacturer  |                 |
| 5                                                                                                         | Purchase order No.                                                                                                                                                                                                             | Date                              |                                   |                                   | Inquiry No.   | Requisition No. |
| 6                                                                                                         |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 7                                                                                                         | Explanations:                                                                                                                                                                                                                  |                                   |                                   |                                   |               |                 |
| 8                                                                                                         | - The information on this data sheet may be completed by either party, but by vendor if not by purchaser, as indicated by ∇.                                                                                                   |                                   |                                   |                                   |               |                 |
| 9                                                                                                         | ∇ Instrument suppliers:                                                                                                                                                                                                        |                                   | Manufacturer                      |                                   | Description   |                 |
| 10                                                                                                        | Pressure gauges                                                                                                                                                                                                                |                                   | Required                          |                                   |               |                 |
| 11                                                                                                        | Temperature gauges                                                                                                                                                                                                             |                                   | Required                          |                                   |               |                 |
| 12                                                                                                        | Level gauges                                                                                                                                                                                                                   |                                   | Required                          |                                   |               |                 |
| 13                                                                                                        | Differential pressure gauges                                                                                                                                                                                                   |                                   | Required                          |                                   |               |                 |
| 14                                                                                                        | Pressure switches                                                                                                                                                                                                              |                                   | Not allowed                       |                                   | Not allowed   |                 |
| 15                                                                                                        | Differential pressure switches                                                                                                                                                                                                 |                                   | Not allowed                       |                                   | Not allowed   |                 |
| 16                                                                                                        | Temperature switches                                                                                                                                                                                                           |                                   | Not allowed                       |                                   | Not allowed   |                 |
| 17                                                                                                        | Level switches                                                                                                                                                                                                                 |                                   | Not allowed                       |                                   | Not allowed   |                 |
| 18                                                                                                        | Control valves                                                                                                                                                                                                                 |                                   | Required                          |                                   |               |                 |
| 19                                                                                                        | Pressure relief valve                                                                                                                                                                                                          |                                   | Required                          |                                   |               |                 |
| 20                                                                                                        | Thermal relief valve                                                                                                                                                                                                           |                                   | Required                          |                                   |               |                 |
| 21                                                                                                        | Sight flow indicators                                                                                                                                                                                                          |                                   | Required                          |                                   |               |                 |
| 22                                                                                                        | Pressure transmitter                                                                                                                                                                                                           |                                   | Required                          |                                   |               |                 |
| 23                                                                                                        | Temperature transmitter                                                                                                                                                                                                        |                                   | Required                          |                                   |               |                 |
| 24                                                                                                        | Level transmitter                                                                                                                                                                                                              |                                   | Required                          |                                   |               |                 |
| 25                                                                                                        | Differential pressure transmitter                                                                                                                                                                                              |                                   | Required                          |                                   |               |                 |
| 26                                                                                                        | Vibration equipment                                                                                                                                                                                                            |                                   | Required                          |                                   |               |                 |
| 27                                                                                                        | Tachometer                                                                                                                                                                                                                     |                                   | Required                          |                                   |               |                 |
| 28                                                                                                        | Solenoid valves                                                                                                                                                                                                                |                                   | Required                          |                                   |               |                 |
| 29                                                                                                        | Annunciator                                                                                                                                                                                                                    |                                   | Required                          |                                   |               |                 |
| 30                                                                                                        | Thermocouples                                                                                                                                                                                                                  |                                   | Required                          |                                   |               |                 |
| 31                                                                                                        | Resistance temperature detectors (RTDs)                                                                                                                                                                                        |                                   | Required                          |                                   |               |                 |
| 32                                                                                                        | Thermowells                                                                                                                                                                                                                    |                                   | Required                          |                                   |               |                 |
| 33                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 34                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 35                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 36                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 37                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 38                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 39                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 40                                                                                                        | Alarm/trip wiring per arrangement 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input checked="" type="checkbox"/> including clarifications and modifications, refer to GS EP MEC 281 ( ISO 10438-1 Clause 6.2.3.3) |                                   |                                   |                                   |               |                 |
| 41                                                                                                        | <input type="radio"/> Purchaser's review and acceptance of components prior to purchase                                                                                                                                        |                                   |                                   |                                   |               |                 |
| 42                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 43                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 44                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 45                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 46                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 47                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 48                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 49                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 50                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| 51                                                                                                        |                                                                                                                                                                                                                                |                                   |                                   |                                   |               |                 |
| COMPANY REFERENCES                                                                                        |                                                                                                                                                                                                                                |                                   | SUPPLIER REFERENCES               |                                   |               |                 |
|                                                                                                           |                                                                                                                                                                                                                                |                                   | Company :                         |                                   |               |                 |
|                                                                                                           |                                                                                                                                                                                                                                |                                   | JOB N° :                          |                                   |               |                 |

| TOTAL                                                                                                     |                                                                                                                                    | DATA SHEET                        |                                   |                                   |               |                 |
|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---------------|-----------------|
|                                                                                                           |                                                                                                                                    | Main Project Title                |                                   |                                   | Page 4 of 6   |                 |
| Issuing Dpt                                                                                               | Rev. / Date                                                                                                                        | 1/                                | 2/                                | 3/                                | 4/            | 5/              |
| Written by :                                                                                              |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS AND AUXILIARIES ACCORDING TO ISO 10438-1 / API STD 614 |                                                                                                                                    |                                   |                                   |                                   | DS EP MEC 281 |                 |
| Annex A - Data Sheets                                                                                     |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| Table A4 - Data sheet local instruments and panel                                                         |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| Job No.:                                                                                                  |                                                                                                                                    |                                   |                                   | Item No.:                         |               |                 |
| 1                                                                                                         | Applicable to                                                                                                                      | <input type="checkbox"/> Proposal | <input type="checkbox"/> Purchase | <input type="checkbox"/> As built |               |                 |
| 2                                                                                                         | For                                                                                                                                |                                   |                                   |                                   | Site          |                 |
| 3                                                                                                         | Oil system for                                                                                                                     |                                   |                                   |                                   |               |                 |
| 4                                                                                                         | Supplier                                                                                                                           |                                   |                                   |                                   | Manufacturer  |                 |
| 5                                                                                                         | Purchase order No.                                                                                                                 |                                   | Date                              |                                   | Inquiry No.   | Requisition No. |
| 6                                                                                                         |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 7                                                                                                         | <b>Explanations:</b>                                                                                                               |                                   |                                   |                                   |               |                 |
| 8                                                                                                         | - The party to complete the information is indicated as follow s:                                                                  |                                   |                                   |                                   |               |                 |
| 9                                                                                                         | <input type="radio"/> Purchaser <input type="checkbox"/> Vendor <input type="checkbox"/> Either, but by vendor if not by purchaser |                                   |                                   |                                   |               |                 |
| 10                                                                                                        | Service                                                                                                                            | Console gauge board               | Local equipment panel             | Remote equipment panel            |               |                 |
| 11                                                                                                        | <input type="radio"/> Panel identification                                                                                         |                                   |                                   |                                   |               |                 |
| 12                                                                                                        | <input checked="" type="radio"/> Supplied by                                                                                       | Vendor                            | Vendor                            | Vendor                            |               |                 |
| 13                                                                                                        | <input type="radio"/> Type: Free-standing                                                                                          |                                   |                                   |                                   |               |                 |
| 14                                                                                                        | Mounted on                                                                                                                         |                                   |                                   | In door                           |               |                 |
| 15                                                                                                        | <input checked="" type="radio"/> Open or fully enclosed                                                                            | Open type                         | Open type                         |                                   |               |                 |
| 16                                                                                                        | <input type="radio"/> Weather tight                                                                                                |                                   |                                   |                                   |               |                 |
| 17                                                                                                        | <input type="radio"/> Purged or pressurized                                                                                        | Not allow ed                      | Not allow ed                      | Not allow ed                      |               |                 |
| 18                                                                                                        | <input type="radio"/> Purge or pressure gas                                                                                        | Not allow ed                      | Not allow ed                      | Not allow ed                      |               |                 |
| 19                                                                                                        | <input type="radio"/> Shutoff valves for shutdown n sensing devices                                                                |                                   |                                   |                                   |               |                 |
| 20                                                                                                        | <input type="radio"/> Annunciator system                                                                                           | Not allow ed                      | Not allow ed                      | Vendor                            |               |                 |
| 21                                                                                                        | <input type="radio"/> Rear access doors                                                                                            |                                   |                                   |                                   |               |                 |
| 22                                                                                                        | <input type="radio"/> Walk-in facility                                                                                             |                                   |                                   |                                   |               |                 |
| 23                                                                                                        | <input type="radio"/> Sun and weather roof extension                                                                               | as needed                         | as needed                         |                                   |               |                 |
| 24                                                                                                        | <input type="radio"/> Light panel front/interior                                                                                   |                                   |                                   |                                   |               |                 |
| 25                                                                                                        | <input type="radio"/> Limits: max height above floor                                                                               |                                   |                                   |                                   |               |                 |
| 26                                                                                                        | <input type="radio"/> Low est item above floor                                                                                     |                                   |                                   |                                   |               |                 |
| 27                                                                                                        | <input checked="" type="radio"/> Spare terminals required                                                                          | 20%                               | 20%                               | 20%                               |               |                 |
| 28                                                                                                        | <input checked="" type="radio"/> Minimum wire size                                                                                 | Refer to IEC standards            | Refer to IEC standards            | Refer to IEC standards            |               |                 |
| 29                                                                                                        | ▼ Material: front panel                                                                                                            | 316 Stainless steel               | 316 Stainless steel               |                                   |               |                 |
| 30                                                                                                        | ▼ Other panels and doors                                                                                                           | 316 Stainless steel               | 316 Stainless steel               |                                   |               |                 |
| 31                                                                                                        | ▼ Chassis                                                                                                                          | 316 Stainless steel               | 316 Stainless steel               |                                   |               |                 |
| 32                                                                                                        | <input type="radio"/> Vibration isolator                                                                                           |                                   |                                   |                                   |               |                 |
| 33                                                                                                        | <input type="radio"/> Electrical area classification                                                                               |                                   |                                   |                                   |               |                 |
| 34                                                                                                        | <input type="radio"/> Panel pow er supply                                                                                          |                                   |                                   |                                   |               |                 |
| 35                                                                                                        | <input type="radio"/> Extra cut-outs required                                                                                      |                                   |                                   |                                   |               |                 |
| 36                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 37                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 38                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 39                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 40                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 41                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 42                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 43                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 44                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 45                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 46                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 47                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 48                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 49                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 50                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| 51                                                                                                        |                                                                                                                                    |                                   |                                   |                                   |               |                 |
| COMPANY REFERENCES                                                                                        |                                                                                                                                    | SUPPLIER REFERENCES               |                                   |                                   |               |                 |
|                                                                                                           |                                                                                                                                    | Company :                         |                                   |                                   |               |                 |
|                                                                                                           |                                                                                                                                    | JOB N° :                          |                                   |                                   |               |                 |

Column blank for revision number (X)

|                          |                                                                                                                                    | DATA SHEET                                                                     |                                           |                          |                                                   |                          |                          |
|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------------------|--------------------------|---------------------------------------------------|--------------------------|--------------------------|
|                                                                                                           |                                                                                                                                    | Main Project Title                                                             |                                           |                          | Page 5 of 6                                       |                          |                          |
| Issuing Dpt                                                                                               | Rev. / Date                                                                                                                        | 1/                                                                             | 2/                                        | 3/                       | 4/                                                | 5/                       |                          |
| Written by :                                                                                              |                                                                                                                                    |                                                                                |                                           |                          |                                                   |                          |                          |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS AND AUXILIARIES ACCORDING TO ISO 10438-1 / API STD 614 |                                                                                                                                    |                                                                                |                                           |                          | DS EP MEC 281                                     |                          |                          |
| Annex A - Data Sheets                                                                                     |                                                                                                                                    |                                                                                |                                           |                          |                                                   |                          |                          |
| Table A4 - Data sheet local instruments and panel (continued)                                             |                                                                                                                                    |                                                                                |                                           |                          |                                                   |                          |                          |
| Job No.:                                                                                                  |                                                                                                                                    |                                                                                |                                           |                          | Item No.:                                         |                          |                          |
| 1                                                                                                         | Applicable to                                                                                                                      | <input type="checkbox"/> Proposal <input checked="" type="checkbox"/> Purchase |                                           |                          | <input type="checkbox"/> As built                 |                          |                          |
| 2                                                                                                         | For                                                                                                                                |                                                                                |                                           |                          | Site                                              |                          |                          |
| 3                                                                                                         | Oil system for                                                                                                                     |                                                                                |                                           |                          |                                                   |                          |                          |
| 4                                                                                                         | Supplier                                                                                                                           |                                                                                |                                           |                          | Manufacturer                                      |                          |                          |
| 5                                                                                                         | Purchase order No.                                                                                                                 | Date                                                                           |                                           |                          | Inquiry No. Requisition No.                       |                          |                          |
| 6                                                                                                         |                                                                                                                                    |                                                                                |                                           |                          |                                                   |                          |                          |
| 7                                                                                                         | Explanations:                                                                                                                      |                                                                                |                                           |                          |                                                   |                          |                          |
| 8                                                                                                         | - The party to complete the information is indicated as follow s:                                                                  |                                                                                |                                           |                          |                                                   |                          |                          |
| 9                                                                                                         | <input type="radio"/> Purchaser <input type="checkbox"/> Vendor <input type="checkbox"/> Either, but by vendor if not by purchaser |                                                                                |                                           |                          |                                                   |                          |                          |
| 10                                                                                                        | Use the following code letters for details of panel mounted items:                                                                 |                                                                                |                                           |                          |                                                   |                          |                          |
| 11                                                                                                        | L - Locally mount on piping                                                                                                        |                                                                                | B - Local equipment panel                 |                          | C - Remote equipment panel                        |                          |                          |
| 12                                                                                                        | F - Flush mount on front                                                                                                           |                                                                                | H - Purchaser remote mount (control room) |                          | CP - Cut-out to purchaser item                    |                          |                          |
| 13                                                                                                        | S - Surface mount on front                                                                                                         |                                                                                | P - Purchaser supply and mount            |                          | M - Mount by vendor of purchaser supplied item    |                          |                          |
| 14                                                                                                        | R - Rear of panel mount                                                                                                            |                                                                                | V - Vendor supply and mount               |                          |                                                   |                          |                          |
| 15                                                                                                        | Equipment instrumentation                                                                                                          |                                                                                |                                           |                          |                                                   |                          |                          |
| 16                                                                                                        | Panel identification                                                                                                               | L                                                                              | B                                         | C                        | Panel identification                              | L                        | B                        |
| 17                                                                                                        | Pressure (gauges and transmitters)                                                                                                 | V                                                                              | V                                         | V                        | Push button stations                              | V                        | V                        |
| 18                                                                                                        | <input type="radio"/> Main turbine inlet                                                                                           | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Main equipment start        | <input type="checkbox"/> | <input type="checkbox"/> |
| 19                                                                                                        | <input type="radio"/> Main turbine first stage                                                                                     | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Main equipment stop         | <input type="checkbox"/> | <input type="checkbox"/> |
| 20                                                                                                        | <input type="radio"/> Main turbine extraction                                                                                      | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Compressor block-in         | <input type="checkbox"/> | <input type="checkbox"/> |
| 21                                                                                                        | <input type="radio"/> Main turbine exhaust                                                                                         | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Compressor unblock          | <input type="checkbox"/> | <input type="checkbox"/> |
| 22                                                                                                        | <input type="radio"/> Steam chest                                                                                                  | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | Miscellaneous                                     |                          |                          |
| 23                                                                                                        | <input type="radio"/> First stage after extraction                                                                                 | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Equipment tachometer        | <input type="checkbox"/> | <input type="checkbox"/> |
| 24                                                                                                        | <input type="radio"/> Nozzle bow l                                                                                                 | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Equipment speed control     | <input type="checkbox"/> | <input type="checkbox"/> |
| 25                                                                                                        | <input type="radio"/> Steam seal                                                                                                   | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Equipment ammeter           | <input type="checkbox"/> | <input type="checkbox"/> |
| 26                                                                                                        | <input type="radio"/> Ejector/educator stem                                                                                        | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Compressor inlet controller | <input type="checkbox"/> | <input type="checkbox"/> |
| 27                                                                                                        | <input type="radio"/> Compressor suction                                                                                           | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Annunciation system         | <input type="checkbox"/> | <input type="checkbox"/> |
| 28                                                                                                        | <input type="radio"/> Compressor discharge                                                                                         | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Equipment flow meter        | <input type="checkbox"/> | <input type="checkbox"/> |
| 29                                                                                                        | <input type="radio"/> Each compressor section                                                                                      | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Guide vane positioner       | <input type="checkbox"/> | <input type="checkbox"/> |
| 30                                                                                                        | <input type="radio"/> Balance chamber                                                                                              | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Suction throttle valve      | <input type="checkbox"/> | <input type="checkbox"/> |
| 31                                                                                                        | Differential pressure (gauges and transmitters)                                                                                    | V                                                                              | V                                         | V                        | <input type="radio"/> Anti-surge equipment        | <input type="checkbox"/> | <input type="checkbox"/> |
| 32                                                                                                        | <input type="radio"/> Compressor air filter                                                                                        | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Capacity control equipment  | <input type="checkbox"/> | <input type="checkbox"/> |
| 33                                                                                                        | <input type="radio"/> Buffer gas                                                                                                   | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Instrument air supply       | <input type="checkbox"/> | <input type="checkbox"/> |
| 34                                                                                                        | <input type="radio"/> Balance chamber                                                                                              | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Seal gas supply             | <input type="checkbox"/> | <input type="checkbox"/> |
| 35                                                                                                        | <input type="radio"/> Other                                                                                                        | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Buffer gas supply           | <input type="checkbox"/> | <input type="checkbox"/> |
| 36                                                                                                        | Temperature (gauges and transmitters)                                                                                              | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Other                       | <input type="checkbox"/> | <input type="checkbox"/> |
| 37                                                                                                        | <input type="radio"/> Main turbine inlet steam                                                                                     | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Other                       | <input type="checkbox"/> | <input type="checkbox"/> |
| 38                                                                                                        | <input type="radio"/> Main turbine exhaust                                                                                         | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Other                       | <input type="checkbox"/> | <input type="checkbox"/> |
| 39                                                                                                        | <input type="radio"/> Main turbine extradiation/induction                                                                          | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Other                       | <input type="checkbox"/> | <input type="checkbox"/> |
| 40                                                                                                        | <input type="radio"/> Compressor suction (each section)                                                                            | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | Monitors                                          |                          |                          |
| 41                                                                                                        | <input type="radio"/> Compressor discharge (each section)                                                                          | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Vibration                   | <input type="checkbox"/> | <input type="checkbox"/> |
| 42                                                                                                        | <input type="radio"/> Other                                                                                                        | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Axial position              | <input type="checkbox"/> | <input type="checkbox"/> |
| 43                                                                                                        | <input type="radio"/> Level indicators/controllers                                                                                 | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Thrust bearing metal temp   | <input type="checkbox"/> | <input type="checkbox"/> |
| 44                                                                                                        | <input type="radio"/> Suction separator                                                                                            | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> | <input type="radio"/> Journal bearing metal temps | <input type="checkbox"/> | <input type="checkbox"/> |
| 45                                                                                                        | <input type="radio"/> Interstage separator                                                                                         | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> |                                                   |                          |                          |
| 46                                                                                                        | <input type="radio"/> Discharge separator                                                                                          | <input type="checkbox"/>                                                       | <input type="checkbox"/>                  | <input type="checkbox"/> |                                                   |                          |                          |
| 47                                                                                                        |                                                                                                                                    |                                                                                |                                           |                          |                                                   |                          |                          |
| 48                                                                                                        |                                                                                                                                    |                                                                                |                                           |                          |                                                   |                          |                          |
| 49                                                                                                        |                                                                                                                                    |                                                                                |                                           |                          |                                                   |                          |                          |
| 50                                                                                                        |                                                                                                                                    |                                                                                |                                           |                          |                                                   |                          |                          |
| 51                                                                                                        |                                                                                                                                    |                                                                                |                                           |                          |                                                   |                          |                          |
| COMPANY REFERENCES                                                                                        |                                                                                                                                    |                                                                                |                                           | SUPPLIER REFERENCES      |                                                   |                          |                          |
|                                                                                                           |                                                                                                                                    |                                                                                |                                           | Company :                |                                                   |                          |                          |
|                                                                                                           |                                                                                                                                    |                                                                                |                                           | JOB N° :                 |                                                   |                          |                          |

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## General Specification

**GS EP MEC 281**

Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries  
according to ISO 10438 / API Standard 614

Rev.: 10

Effective date: 10/2012

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|                                                                                                                     |                                                                                                                                                                                                                      | DATA SHEET                        |                                   |                                   |               |                 |
|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---------------|-----------------|
|                                                                                                                     |                                                                                                                                                                                                                      | Main Project Title                |                                   |                                   |               |                 |
|                                                                                                                     |                                                                                                                                                                                                                      |                                   |                                   |                                   | Page          | 6 of 6          |
| Issuing Dpt                                                                                                         | Rev. / Date                                                                                                                                                                                                          | 1/                                | 2/                                | 3/                                | 4/            | 5/              |
| Written by :                                                                                                        |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO <b>ISO 10438-1 / API STD 614</b> |                                                                                                                                                                                                                      |                                   |                                   |                                   | DS EP MEC 281 |                 |
| Annex A - Data Sheets                                                                                               |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| Table A4 - Data sheet local instruments and panel (continued)                                                       |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| Job No.:                                                                                                            |                                                                                                                                                                                                                      |                                   |                                   | Item No.:                         |               |                 |
| 1                                                                                                                   | Applicable to                                                                                                                                                                                                        | <input type="checkbox"/> Proposal | <input type="checkbox"/> Purchase | <input type="checkbox"/> As built |               |                 |
| 2                                                                                                                   | For                                                                                                                                                                                                                  |                                   |                                   |                                   | Site          |                 |
| 3                                                                                                                   | Oil system for                                                                                                                                                                                                       |                                   |                                   |                                   |               |                 |
| 4                                                                                                                   | Supplier                                                                                                                                                                                                             |                                   |                                   |                                   | Manufacturer  |                 |
| 5                                                                                                                   | Purchase order No.                                                                                                                                                                                                   |                                   | Date                              |                                   | Inquiry No.   | Requisition No. |
| 6                                                                                                                   |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 7                                                                                                                   | <b>Explanations:</b>                                                                                                                                                                                                 |                                   |                                   |                                   |               |                 |
| 8                                                                                                                   | - The party to complete the information is indicated as follows:                                                                                                                                                     |                                   |                                   |                                   |               |                 |
| 9                                                                                                                   | <input type="radio"/> Purchaser <input type="checkbox"/> Vendor <input type="checkbox"/> Either, but by vendor if not by purchaser                                                                                   |                                   |                                   |                                   |               |                 |
| 10                                                                                                                  | - An asterisk * specifies a requirement, value or criterion.                                                                                                                                                         |                                   |                                   |                                   |               |                 |
| 11                                                                                                                  | - Designations in parentheses ( ) are: explained in the cited standard; numbers without a prefix are subclause numbers; those prefixed "T" are text figure numbers; those prefixed "A" are Annex "A" figure numbers. |                                   |                                   |                                   |               |                 |
| 12                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 13                                                                                                                  | <b>Instrumentation</b>                                                                                                                                                                                               |                                   |                                   |                                   |               |                 |
| 14                                                                                                                  | <input checked="" type="radio"/> Signal segregation requirements provided by purchaser <input checked="" type="radio"/> Spare parts quotation with proposal                                                          |                                   |                                   |                                   |               |                 |
| 15                                                                                                                  | Wiring to be installed in: <input type="radio"/> Metal conduit <input checked="" type="radio"/> Cable trays <input type="radio"/> Enclosures                                                                         |                                   |                                   |                                   |               |                 |
| 16                                                                                                                  | Switches shall be wired to: <input type="radio"/> Open (de-energized) or <input checked="" type="radio"/> Close (energized) to initiate alarms and shutdowns                                                         |                                   |                                   |                                   |               |                 |
| 17                                                                                                                  | <input checked="" type="radio"/> Signal segregation required                                                                                                                                                         |                                   |                                   |                                   |               |                 |
| 18                                                                                                                  | <input checked="" type="radio"/> Transmitters shall be provided Output signal type _____ Housing typ _____                                                                                                           |                                   |                                   |                                   |               |                 |
| 19                                                                                                                  | <input type="radio"/> Analog <input checked="" type="radio"/> Digital <input checked="" type="radio"/> Indicating type <input type="radio"/> Non indicating type (blind)                                             |                                   |                                   |                                   |               |                 |
| 20                                                                                                                  | <input type="radio"/> Non-Hazardous <input checked="" type="radio"/> Non-incendive <input type="radio"/> Explosion proof <input type="radio"/> Intrinsically safe (IS)                                               |                                   |                                   |                                   |               |                 |
| 21                                                                                                                  | <input checked="" type="radio"/> Liquid-filled or dampened movement gauges shall be furnished                                                                                                                        |                                   |                                   |                                   |               |                 |
| 22                                                                                                                  | <input checked="" type="radio"/> Sight flow indicators installed in the drain lines of totally enclosed dry coupling guards                                                                                          |                                   |                                   |                                   |               |                 |
| 23                                                                                                                  | <input type="radio"/> Restrictive flow indicators installed on in the pressurized inlet line to each continuously lubricated coupling                                                                                |                                   |                                   |                                   |               |                 |
| 24                                                                                                                  | <input checked="" type="radio"/> Continuously energized solenoids required for trip circuits                                                                                                                         |                                   |                                   |                                   |               |                 |
| 25                                                                                                                  | <input checked="" type="radio"/> Thermal relief valves provided for components that may be blocked in by isolation valves                                                                                            |                                   |                                   |                                   |               |                 |
| 26                                                                                                                  | <b>Electrical systems</b>                                                                                                                                                                                            |                                   |                                   |                                   |               |                 |
| 27                                                                                                                  | <input type="radio"/> Characteristics of electrical power supplies for motors, heater and instruments shall be specified                                                                                             |                                   |                                   |                                   |               |                 |
| 28                                                                                                                  | <input type="radio"/> Instrument and control wiring may be solid conductors in areas not subject to vibration                                                                                                        |                                   |                                   |                                   |               |                 |
| 29                                                                                                                  | Wiring installed in <input type="radio"/> Metal conduit <input checked="" type="radio"/> Cable trays <input type="radio"/> Enclosures                                                                                |                                   |                                   |                                   |               |                 |
| 30                                                                                                                  | <input type="radio"/> Conduit drains provided in all conduit low points for indoor installations                                                                                                                     |                                   |                                   |                                   |               |                 |
| 31                                                                                                                  | <input type="radio"/> Electrical materials, including insulation, shall be corrosion resistant and non-hygroscopic                                                                                                   |                                   |                                   |                                   |               |                 |
| 32                                                                                                                  | Alarm/trip wiring per arrangement: <input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> 3 including clarifications refer to GS EP MEC 281                                                |                                   |                                   |                                   |               |                 |
| 33                                                                                                                  | Any alarm shall initiate: <input type="radio"/> Audible warning <input type="radio"/> Flashing light <input checked="" type="radio"/> Both Audible Warning and flashing light                                        |                                   |                                   |                                   |               |                 |
| 34                                                                                                                  | any shutdown shall initiate: <input type="radio"/> Audible warning <input type="radio"/> Flashing light <input checked="" type="radio"/> Both Audible Warning and flashing light                                     |                                   |                                   |                                   |               |                 |
| 35                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 36                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 37                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 38                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 39                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 40                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 41                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 42                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 43                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 44                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 45                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 46                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 47                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 48                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 49                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 50                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| 51                                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   |                                   |               |                 |
| COMPANY REFERENCES                                                                                                  |                                                                                                                                                                                                                      |                                   |                                   | SUPPLIER REFERENCES               |               |                 |
|                                                                                                                     |                                                                                                                                                                                                                      |                                   |                                   | Company :                         |               |                 |
|                                                                                                                     |                                                                                                                                                                                                                      |                                   |                                   | JOB N° :                          |               |                 |

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| General Specification                                                                                            |                         | GS EP MEC 281   |
|------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------|
| Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries<br>according to ISO 10438 / API Standard 614 |                         |                 |
| Rev.: 10                                                                                                         | Effective date: 10/2012 | Page: 94 of 111 |

## Datasheet **ISO 10438-2**



## General Specification

**GS EP MEC 281**

Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries  
according to ISO 10438 / API Standard 614

Rev.: 10

Effective date: 10/2012

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|                                                                                                              |                                                                                                                                                                    | DATA SHEET                        |                                   |                                                                                                  |                          |                                              |
|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------|--------------------------------------------------------------------------------------------------|--------------------------|----------------------------------------------|
|                                                                                                              |                                                                                                                                                                    | Main Project Title                |                                   |                                                                                                  | Page 1 of 7              |                                              |
| Issuing Dpt                                                                                                  | Rev. / Date                                                                                                                                                        | 1/                                | 2/                                | 3/                                                                                               | 4/                       | 5/                                           |
| Written by :                                                                                                 |                                                                                                                                                                    |                                   |                                   |                                                                                                  |                          |                                              |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO ISO 10438-2 / API STD 614 |                                                                                                                                                                    |                                   |                                   |                                                                                                  | DS EP MEC 281            |                                              |
| Annex B - Special-purpose oil system data sheets                                                             |                                                                                                                                                                    |                                   |                                   |                                                                                                  |                          |                                              |
| Table B1 - Data sheet special-purpose oil system - SI units                                                  |                                                                                                                                                                    |                                   |                                   |                                                                                                  |                          |                                              |
| Job No.:                                                                                                     |                                                                                                                                                                    |                                   |                                   | Item No.:                                                                                        |                          |                                              |
| 1                                                                                                            | Applicable to                                                                                                                                                      | <input type="checkbox"/> Proposal | <input type="checkbox"/> Purchase | <input type="checkbox"/> As built                                                                |                          |                                              |
| 2                                                                                                            | For                                                                                                                                                                |                                   |                                   |                                                                                                  | Site                     |                                              |
| 3                                                                                                            | Oil system for                                                                                                                                                     |                                   |                                   |                                                                                                  |                          |                                              |
| 4                                                                                                            | Supplier                                                                                                                                                           |                                   |                                   |                                                                                                  | Manufacturer             |                                              |
| 5                                                                                                            | Purchase order No.                                                                                                                                                 |                                   | Date                              |                                                                                                  | Inquiry No.              | Requisition No.                              |
| 6                                                                                                            |                                                                                                                                                                    |                                   |                                   |                                                                                                  |                          |                                              |
| 7                                                                                                            | <b>Explanations:</b>                                                                                                                                               |                                   |                                   |                                                                                                  |                          |                                              |
| 8                                                                                                            | - The party to complete the information is indicated as follow s:                                                                                                  |                                   |                                   |                                                                                                  |                          |                                              |
| 9                                                                                                            | <input type="radio"/> Purchaser <input type="checkbox"/> Vendor <input type="checkbox"/> Either, but by vendor if not by purchaser                                 |                                   |                                   |                                                                                                  |                          |                                              |
| 10                                                                                                           | - An asterisk * specifies a requirement, value or criterion.                                                                                                       |                                   |                                   |                                                                                                  |                          |                                              |
| 11                                                                                                           | - Designations in parentheses ( ) are: explained in the cited standard; those prefixed "T" are text figure numbers; those prefixed "A" are Annex A figure numbers. |                                   |                                   |                                                                                                  |                          |                                              |
| 12                                                                                                           |                                                                                                                                                                    |                                   |                                   |                                                                                                  |                          |                                              |
| 13                                                                                                           | Overall system typical schemas                                                                                                                                     |                                   | Figure No.                        | Option Nos.                                                                                      | Comment                  |                                              |
| 14                                                                                                           | <input type="radio"/> Combined lube, seal, and control system                                                                                                      |                                   |                                   |                                                                                                  |                          |                                              |
| 15                                                                                                           | <input type="radio"/> Separate seal-oil system                                                                                                                     |                                   |                                   |                                                                                                  |                          |                                              |
| 16                                                                                                           | <input type="radio"/> Seal module at equipment                                                                                                                     |                                   |                                   |                                                                                                  |                          |                                              |
| 17                                                                                                           | <input checked="" type="radio"/> Lube/control system                                                                                                               |                                   |                                   |                                                                                                  |                          |                                              |
| 18                                                                                                           | <input type="radio"/> Basic oil supply module                                                                                                                      |                                   |                                   |                                                                                                  |                          |                                              |
| 19                                                                                                           | <input type="radio"/> Lube module at equipment                                                                                                                     |                                   |                                   |                                                                                                  |                          |                                              |
| 20                                                                                                           | <input type="radio"/> Drawing requirements                                                                                                                         |                                   |                                   | <input type="radio"/> Component review                                                           |                          |                                              |
| 21                                                                                                           | Oil requirements: See 10438-1:2003 data sheet                                                                                                                      |                                   |                                   |                                                                                                  |                          |                                              |
| 22                                                                                                           | Supply arrangement:                                                                                                                                                |                                   | Lube oil                          | Seal oil                                                                                         | Combined                 | Baseplates:                                  |
| 23                                                                                                           | <input type="radio"/> Separate console                                                                                                                             |                                   | <input type="checkbox"/>          | <input type="checkbox"/>                                                                         | <input type="checkbox"/> | <input type="radio"/> Point support          |
| 24                                                                                                           | <input type="radio"/> Multiple package                                                                                                                             |                                   | <input type="checkbox"/>          | <input type="checkbox"/>                                                                         | <input type="checkbox"/> | <input type="radio"/> Grout holes/vent holes |
| 25                                                                                                           | <input type="radio"/> Package No. 1                                                                                                                                |                                   |                                   |                                                                                                  |                          | <input type="radio"/> Epoxy grout precoat    |
| 26                                                                                                           | <input type="radio"/> Package No. 2                                                                                                                                |                                   |                                   |                                                                                                  |                          | <input type="radio"/> Flat decking           |
| 27                                                                                                           | <input type="radio"/> Package No. 3                                                                                                                                |                                   |                                   |                                                                                                  |                          |                                              |
| 28                                                                                                           | Basic system details:                                                                                                                                              |                                   |                                   |                                                                                                  |                          |                                              |
| 29                                                                                                           | <input type="radio"/> Compressor block-in time min                                                                                                                 |                                   |                                   | <input type="radio"/> Process relief valve setting (kPa)                                         |                          |                                              |
| 30                                                                                                           | <input type="checkbox"/> Equipment coast-down min                                                                                                                  |                                   |                                   | <input type="radio"/> Shop test conditions                                                       |                          |                                              |
| 31                                                                                                           | Equipment cool-off time:                                                                                                                                           |                                   |                                   |                                                                                                  |                          |                                              |
| 32                                                                                                           | <input type="checkbox"/> Driver min                                                                                                                                |                                   |                                   | <input type="radio"/> Field start-up/run-in conditions                                           |                          |                                              |
| 33                                                                                                           | <input type="checkbox"/> Other min                                                                                                                                 |                                   |                                   | <input type="radio"/> Other special conditions                                                   |                          |                                              |
| 34                                                                                                           | <input type="checkbox"/> Minimum start-up oil temperature °C                                                                                                       |                                   |                                   | <input type="radio"/> Welding and special fabrication requirements                               |                          |                                              |
| 35                                                                                                           | Other:                                                                                                                                                             |                                   |                                   |                                                                                                  |                          |                                              |
| 36                                                                                                           | <input type="radio"/> Settling-out pressures (kPa)                                                                                                                 |                                   |                                   | <input type="radio"/> 100% radiography                                                           |                          |                                              |
| 37                                                                                                           | <input type="radio"/> Magnetic particle                                                                                                                            |                                   |                                   |                                                                                                  |                          |                                              |
|                                                                                                              | <input type="radio"/> Liquid penetrant                                                                                                                             |                                   |                                   |                                                                                                  |                          |                                              |
|                                                                                                              | <input type="radio"/> Heat loss analysis of system and interconnecting piping                                                                                      |                                   |                                   |                                                                                                  |                          |                                              |
| 38                                                                                                           | Components                                                                                                                                                         |                                   |                                   |                                                                                                  |                          |                                              |
| 39                                                                                                           | Piping and tubing:                                                                                                                                                 |                                   |                                   |                                                                                                  |                          |                                              |
| 40                                                                                                           | <input checked="" type="radio"/> Material (316 SS for piping and/or 409 SS for tubing)                                                                             |                                   |                                   | <input checked="" type="radio"/> Special requirements (Refer to GS EP MEC 281 Part 1 Clause 5.1) |                          |                                              |
| 41                                                                                                           | <input checked="" type="radio"/> Double blocks and bleeds                                                                                                          |                                   |                                   | <input checked="" type="radio"/> Utilities manifolded to common connections                      |                          |                                              |
| 42                                                                                                           | <input checked="" type="radio"/> Tight shutoff                                                                                                                     |                                   |                                   | <input checked="" type="radio"/> Air                                                             |                          |                                              |
| 43                                                                                                           | <input type="radio"/> Tubing fittings-Mfg Model                                                                                                                    |                                   |                                   | <input checked="" type="radio"/> Cooling water                                                   |                          |                                              |
| 44                                                                                                           | <input type="radio"/> Carbon steel slip-on flanges                                                                                                                 |                                   |                                   | <input type="radio"/> Other                                                                      |                          |                                              |
| 45                                                                                                           | <input type="radio"/> Through studs required                                                                                                                       |                                   |                                   | <input checked="" type="radio"/> Instrument test valves required                                 |                          |                                              |
| 46                                                                                                           | <input checked="" type="radio"/> Heat tracing required by <input type="checkbox"/> Purchaser <input checked="" type="checkbox"/> Vendor                            |                                   |                                   | <input checked="" type="radio"/> Valve heads vented to reservoir                                 |                          |                                              |
| 47                                                                                                           |                                                                                                                                                                    |                                   |                                   |                                                                                                  |                          |                                              |
| 48                                                                                                           |                                                                                                                                                                    |                                   |                                   |                                                                                                  |                          |                                              |
| 49                                                                                                           |                                                                                                                                                                    |                                   |                                   |                                                                                                  |                          |                                              |
| 50                                                                                                           |                                                                                                                                                                    |                                   |                                   |                                                                                                  |                          |                                              |
| 51                                                                                                           |                                                                                                                                                                    |                                   |                                   |                                                                                                  |                          |                                              |
| 52                                                                                                           |                                                                                                                                                                    |                                   |                                   |                                                                                                  |                          |                                              |
| COMPANY REFERENCES                                                                                           |                                                                                                                                                                    |                                   | SUPPLIER REFERENCES               |                                                                                                  |                          |                                              |
|                                                                                                              |                                                                                                                                                                    |                                   | Company :                         |                                                                                                  |                          |                                              |
|                                                                                                              |                                                                                                                                                                    |                                   | JOB N° :                          |                                                                                                  |                          |                                              |

Column blank for revision number (X)



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|                                                                                                                      |                                                                               | DATA SHEET                                                          |    |                                   |             |                      |        |
|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------|----|-----------------------------------|-------------|----------------------|--------|
|                                                                                                                      |                                                                               | Main Project Title                                                  |    |                                   |             |                      |        |
|                                                                                                                      |                                                                               |                                                                     |    |                                   |             | Page                 | 2 of 7 |
| Issuing Dpt                                                                                                          | Rev. / Date                                                                   | 1/                                                                  | 2/ | 3/                                | 4/          | 5/                   |        |
|                                                                                                                      |                                                                               | Written by :                                                        |    |                                   |             |                      |        |
| <b>LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br/>AND AUXILIARIES ACCORDING TO ISO 10438-2 / API STD 614</b> |                                                                               |                                                                     |    |                                   |             | <b>DS EP MEC 281</b> |        |
| <b>Annex B - Special-purpose oil system data sheets</b>                                                              |                                                                               |                                                                     |    |                                   |             |                      |        |
| <b>Table B1 - Data sheet special-purpose oil system - SI units (continued)</b>                                       |                                                                               |                                                                     |    |                                   |             |                      |        |
|                                                                                                                      |                                                                               | Job No.:                                                            |    | Item No.:                         |             |                      |        |
| 1                                                                                                                    | Applicable to                                                                 | <input type="checkbox"/> Proposal <input type="checkbox"/> Purchase |    | <input type="checkbox"/> As built |             |                      |        |
| 2                                                                                                                    | Supplier                                                                      |                                                                     |    |                                   |             |                      |        |
| 3                                                                                                                    | Purchase order No.                                                            | Date                                                                |    | Manufacturer                      | Inquiry No. | Requisition No.      |        |
| 4                                                                                                                    |                                                                               |                                                                     |    |                                   |             |                      |        |
| 5                                                                                                                    | <b>Oil conditioners:</b>                                                      |                                                                     |    |                                   |             |                      |        |
| 6                                                                                                                    | <input type="radio"/> Purchaser's item No.                                    |                                                                     |    |                                   |             |                      |        |
| 7                                                                                                                    | <input type="radio"/> Service used in                                         |                                                                     |    |                                   |             |                      |        |
| 8                                                                                                                    |                                                                               |                                                                     |    |                                   |             |                      |        |
| 9                                                                                                                    | <input type="radio"/> Type                                                    |                                                                     |    |                                   |             |                      |        |
| 10                                                                                                                   | <input type="radio"/> Portable / fixed                                        | Movable                                                             |    |                                   |             |                      |        |
| 11                                                                                                                   | <input type="radio"/> Rated flow of oil (m³/h)                                |                                                                     |    |                                   |             |                      |        |
| 12                                                                                                                   | <input type="radio"/> Manufacturer                                            |                                                                     |    |                                   |             |                      |        |
| 13                                                                                                                   | <input type="radio"/> Model                                                   |                                                                     |    |                                   |             |                      |        |
| 14                                                                                                                   | <input type="checkbox"/> Driver for                                           |                                                                     |    |                                   |             |                      |        |
| 15                                                                                                                   | <input type="radio"/> Hp and enclosure                                        |                                                                     |    |                                   |             |                      |        |
| 16                                                                                                                   | <input type="radio"/> Volts/phase (single or 3-phase)/Hz                      |                                                                     |    |                                   |             |                      |        |
| 17                                                                                                                   | <input type="radio"/> / /                                                     |                                                                     |    |                                   |             |                      |        |
| 18                                                                                                                   | <input type="checkbox"/> Water removal rate                                   |                                                                     |    |                                   |             |                      |        |
| 19                                                                                                                   | <input type="radio"/> Material of construction                                | 316 SS                                                              |    |                                   |             |                      |        |
| 20                                                                                                                   | <b>Degassing drum:</b>                                                        |                                                                     |    |                                   |             |                      |        |
| 21                                                                                                                   | <input type="radio"/> Purchaser's item No.                                    |                                                                     |    |                                   |             |                      |        |
| 22                                                                                                                   | <input type="radio"/> Type in accordance with Figure 4 or other specification |                                                                     |    |                                   |             |                      |        |
| 23                                                                                                                   | Operating temp. °C                                                            |                                                                     |    |                                   |             |                      |        |
| 24                                                                                                                   | m³/h normal/max.                                                              |                                                                     |    |                                   |             |                      |        |
| 25                                                                                                                   | Normal retention min                                                          |                                                                     |    |                                   |             |                      |        |
| 26                                                                                                                   | Normal/max. capacity /                                                        |                                                                     |    |                                   |             |                      |        |
| 27                                                                                                                   | <input type="radio"/> Purge gas type                                          |                                                                     |    |                                   |             |                      |        |
| 28                                                                                                                   | <input type="checkbox"/> m³/h required                                        |                                                                     |    |                                   |             |                      |        |
| 29                                                                                                                   | <input type="radio"/> Type heating device                                     |                                                                     |    |                                   |             |                      |        |
| 30                                                                                                                   | <input type="radio"/> Corrosion allowance                                     |                                                                     |    |                                   |             |                      |        |
| 31                                                                                                                   | <input type="radio"/> Design/test (kPa)                                       |                                                                     |    |                                   |             |                      |        |
| 32                                                                                                                   | <input type="radio"/> Other                                                   |                                                                     |    |                                   |             |                      |        |
| 33                                                                                                                   | <input type="radio"/> Other                                                   |                                                                     |    |                                   |             |                      |        |
| 34                                                                                                                   | <input type="radio"/> Other                                                   |                                                                     |    |                                   |             |                      |        |
| 35                                                                                                                   | <input type="radio"/> Service used in                                         |                                                                     |    |                                   |             |                      |        |
| 36                                                                                                                   | <input type="radio"/> Flow control                                            |                                                                     |    |                                   |             |                      |        |
| 37                                                                                                                   | <input type="radio"/> Thermostat control                                      |                                                                     |    |                                   |             |                      |        |
| 38                                                                                                                   | <input type="radio"/> Material                                                |                                                                     |    |                                   |             |                      |        |
| 39                                                                                                                   | <input type="radio"/> Interior coating                                        |                                                                     |    |                                   |             |                      |        |
| 40                                                                                                                   | <input type="radio"/> Oversized vent                                          |                                                                     |    |                                   |             |                      |        |
| 41                                                                                                                   | <input type="radio"/> Vent relief device                                      |                                                                     |    |                                   |             |                      |        |
| 42                                                                                                                   | <input type="radio"/> Omit breather                                           |                                                                     |    |                                   |             |                      |        |
| 43                                                                                                                   | <input type="radio"/> Code construction                                       |                                                                     |    |                                   |             |                      |        |
| 44                                                                                                                   | <input type="radio"/> Code stamp                                              |                                                                     |    |                                   |             |                      |        |
| 45                                                                                                                   | <input type="radio"/> Other                                                   |                                                                     |    |                                   |             |                      |        |
| 46                                                                                                                   | <input type="radio"/> Other                                                   |                                                                     |    |                                   |             |                      |        |
| 47                                                                                                                   | <input type="radio"/> Other                                                   |                                                                     |    |                                   |             |                      |        |
| 48                                                                                                                   | <b>Reservoir:</b>                                                             |                                                                     |    |                                   |             |                      |        |
| 49                                                                                                                   | Service application                                                           |                                                                     |    |                                   |             |                      |        |
| 50                                                                                                                   | <input type="radio"/> Purchaser's item No.                                    |                                                                     |    |                                   |             |                      |        |
| 51                                                                                                                   | <input type="radio"/> Figures No.                                             |                                                                     |    |                                   |             |                      |        |
| 52                                                                                                                   | <input type="radio"/> Include options No.                                     |                                                                     |    |                                   |             |                      |        |
| 53                                                                                                                   | <input type="radio"/> Heater steam/electric (S/E)                             |                                                                     |    |                                   |             |                      |        |
| 54                                                                                                                   | <input type="radio"/> Heater in sealed tube                                   |                                                                     |    |                                   |             |                      |        |
| 55                                                                                                                   | <input type="radio"/> Material                                                |                                                                     |    |                                   |             |                      |        |
| 56                                                                                                                   | <input type="radio"/> Normal flow (m³/h)                                      |                                                                     |    |                                   |             |                      |        |
| 57                                                                                                                   | <input type="radio"/> Free surface (m²)                                       |                                                                     |    |                                   |             |                      |        |
| 58                                                                                                                   | <input type="checkbox"/> Working capacity (m³/min)                            |                                                                     |    |                                   |             |                      |        |
| 59                                                                                                                   | <input type="checkbox"/> Retention capacity (m³)                              |                                                                     |    |                                   |             |                      |        |
| 60                                                                                                                   | <input type="checkbox"/> Rundown capacity (m³)                                |                                                                     |    |                                   |             |                      |        |
| 61                                                                                                                   | <input type="checkbox"/> Normal operating range (m³/min)                      |                                                                     |    |                                   |             |                      |        |
| 62                                                                                                                   | <input type="checkbox"/> Charge capacity (m³)                                 |                                                                     |    |                                   |             |                      |        |
| 63                                                                                                                   | <input type="radio"/> Insulation clips                                        |                                                                     |    |                                   |             |                      |        |
| 64                                                                                                                   | <input type="radio"/> Heat trace & insulation                                 |                                                                     |    |                                   |             |                      |        |
| 65                                                                                                                   | <input type="radio"/> Ladder with handrail                                    |                                                                     |    |                                   |             |                      |        |
| 66                                                                                                                   | <input type="radio"/> Handrails on top                                        |                                                                     |    |                                   |             |                      |        |
| 67                                                                                                                   | <input type="radio"/> Non-skid decking                                        |                                                                     |    |                                   |             |                      |        |
| 68                                                                                                                   | <input type="radio"/> Flanged vent                                            |                                                                     |    |                                   |             |                      |        |
| 69                                                                                                                   | <input type="radio"/> Oversized flanged vent                                  |                                                                     |    |                                   |             |                      |        |
| 70                                                                                                                   | <input type="radio"/> Pressure relief device type                             |                                                                     |    |                                   |             |                      |        |
| 71                                                                                                                   | <input type="radio"/> Siphon breaker                                          |                                                                     |    |                                   |             |                      |        |
| 72                                                                                                                   | <input type="radio"/> Top mounted components permitted                        |                                                                     |    |                                   |             |                      |        |
| 73                                                                                                                   | <input type="checkbox"/> Top mounted components are:                          |                                                                     |    |                                   |             |                      |        |
| 74                                                                                                                   | <input type="checkbox"/> Submerged components and materials                   |                                                                     |    |                                   |             |                      |        |
| 75                                                                                                                   | <input type="checkbox"/> Dimensions of tank L (m) x W (m) x H (m)             |                                                                     |    |                                   |             |                      |        |
| 76                                                                                                                   | <input type="radio"/> Separate connection for seal oil return line            |                                                                     |    |                                   |             |                      |        |
| 77                                                                                                                   | <input type="radio"/> Connection for oil conditioner                          |                                                                     |    |                                   |             |                      |        |
| 78                                                                                                                   | Column blank for revision number (X)                                          |                                                                     |    |                                   |             |                      |        |
| COMPANY REFERENCES                                                                                                   |                                                                               |                                                                     |    | SUPPLIER REFERENCES               |             |                      |        |
|                                                                                                                      |                                                                               |                                                                     |    | Company :                         |             |                      |        |
|                                                                                                                      |                                                                               |                                                                     |    | JOB N° :                          |             |                      |        |

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|                             |                                                                               | DATA SHEET                                                          |                                                     |                                                       |                                                     |                                                     |                                                     |
|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|
|                                                                                                              |                                                                               | Main Project Title                                                  |                                                     |                                                       |                                                     |                                                     |                                                     |
|                                                                                                              |                                                                               |                                                                     |                                                     |                                                       |                                                     | Page                                                | 3 of 7                                              |
| Issuing Dpt                                                                                                  | Rev. / Date                                                                   | 1/                                                                  | 2/                                                  | 3/                                                    | 4/                                                  | 5/                                                  |                                                     |
| Written by :                                                                                                 |                                                                               |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO ISO 10438-2 / API STD 614 |                                                                               |                                                                     |                                                     |                                                       | DS EP MEC 281                                       |                                                     |                                                     |
| Annex B- Special-purpose oil system data sheets                                                              |                                                                               |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| Table B1 - Data sheet special-purpose oil system - SI units (continued)                                      |                                                                               |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| Job No.:                                                                                                     |                                                                               |                                                                     |                                                     | Item No.:                                             |                                                     |                                                     |                                                     |
| 1                                                                                                            | Applicable to                                                                 | <input type="checkbox"/> Proposal <input type="checkbox"/> Purchase |                                                     | <input type="checkbox"/> As built                     |                                                     |                                                     |                                                     |
| 2                                                                                                            | Supplier                                                                      |                                                                     |                                                     | Manufacturer                                          |                                                     |                                                     |                                                     |
| 3                                                                                                            | Purchase order No.                                                            | Date                                                                |                                                     | Inquiry No.                                           |                                                     | Requisition No.                                     |                                                     |
| 4                                                                                                            |                                                                               |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 5                                                                                                            | Pump and drivers                                                              | Lube                                                                | Lube/seal                                           | Separate seal oil                                     | Booster seal                                        |                                                     |                                                     |
| 6                                                                                                            | <input type="radio"/> Service application                                     |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 7                                                                                                            | <input type="radio"/> Figures Nos.                                            |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 8                                                                                                            | <input type="radio"/> Include option Nos.                                     |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 9                                                                                                            | <input type="radio"/> Emergency pump system                                   | <input type="checkbox"/>                                            | <input type="checkbox"/>                            | <input type="checkbox"/>                              | <input type="checkbox"/>                            |                                                     |                                                     |
| 10                                                                                                           | Pump service                                                                  | Main/<br>standby                                                    | Emergency                                           | Main/<br>standby                                      | Emergency                                           | Main/ standby                                       | Emergency                                           |
| 11                                                                                                           | <input type="radio"/> Pump item No.                                           |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 12                                                                                                           | <input type="radio"/> Pump type                                               |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 13                                                                                                           | <input checked="" type="radio"/> Pump data sheet                              |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 14                                                                                                           | <input type="radio"/> Horizontal or vertical (H/V)                            |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 15                                                                                                           | <input type="radio"/> Driver item No.                                         |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 16                                                                                                           | <input type="radio"/> Turbine driver for                                      |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 17                                                                                                           | <input type="radio"/> Turbine data sheet                                      |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 18                                                                                                           | <input checked="" type="radio"/> Electric motor for                           |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 19                                                                                                           | <input checked="" type="radio"/> Electric motor data sheet                    |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 20                                                                                                           | <input type="radio"/> Other driver                                            |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 21                                                                                                           | <input type="radio"/> Other driver data sheet                                 |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 22                                                                                                           | <input checked="" type="radio"/> Coupling type                                | Flexible                                                            | Flexible                                            |                                                       |                                                     |                                                     |                                                     |
| 23                                                                                                           | <input checked="" type="radio"/> Coupling guard type                          | Non sparking                                                        |                                                     |                                                       |                                                     |                                                     |                                                     |
| 24                                                                                                           | <input type="radio"/> Booster pumps required                                  |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 25                                                                                                           | <input type="radio"/> Booster suction protection                              |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 26                                                                                                           | <input type="radio"/> Solenoid trip valve                                     |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 27                                                                                                           | <input checked="" type="radio"/> Rotary pump relief valve by purchaser/vendor | Vendor                                                              | Vendor                                              |                                                       |                                                     |                                                     |                                                     |
| 28                                                                                                           | purchase / vendor                                                             |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 29                                                                                                           | Filters:                                                                      |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 30                                                                                                           | <input type="radio"/> Service application                                     | <input type="radio"/> Lube oil                                      | <input type="radio"/> Seal oil &                    | <input type="radio"/> Separate control oil            | <input type="radio"/> Separate seal oil             | <input type="radio"/> Booster pump discharge oil    | <input type="radio"/> Separate coupling oil         |
| 31                                                                                                           |                                                                               | <input type="radio"/> Control oil                                   |                                                     |                                                       |                                                     |                                                     |                                                     |
| 32                                                                                                           |                                                                               |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 33                                                                                                           | <input type="radio"/> Purchase item No.                                       |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 34                                                                                                           | <input type="radio"/> Twin                                                    | <input type="checkbox"/>                                            | <input type="checkbox"/>                            | <input type="checkbox"/>                              | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |
| 35                                                                                                           | <input type="radio"/> Second filter for control oil                           | <input type="checkbox"/>                                            | <input type="checkbox"/>                            | <input type="checkbox"/>                              | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |
| 36                                                                                                           | <input type="radio"/> Include option Nos.                                     |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 37                                                                                                           | <input type="radio"/> Filtration level                                        |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 38                                                                                                           | <input type="radio"/> Non-hydroscopic filter element                          |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 39                                                                                                           | <input type="radio"/> Manufacturer                                            |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 40                                                                                                           | <input type="radio"/> Model                                                   |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 41                                                                                                           | <input type="radio"/> Design/test pressure (kPa)                              | /                                                                   | /                                                   | /                                                     | /                                                   | /                                                   | /                                                   |
| 42                                                                                                           | <input type="radio"/> Test pressure (kPa)                                     |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 43                                                                                                           | <input type="radio"/> Code const/stamp                                        | <input type="checkbox"/> / <input type="checkbox"/>                 | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/>   | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> |
| 44                                                                                                           | <input type="radio"/> Thermal protection of offline filter                    |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 45                                                                                                           | <input type="radio"/> Manifold filter and cooler drains                       |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 46                                                                                                           | <input type="radio"/> Filter vents routed to reservoir                        |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 47                                                                                                           | Material: case and top                                                        |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 48                                                                                                           | Cartridges:                                                                   |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 49                                                                                                           | Furnish                                                                       | extra sets of cartridges                                            | <input type="radio"/> per service                   | <input type="radio"/> per filter (extra other spares) |                                                     |                                                     |                                                     |
| 50                                                                                                           |                                                                               |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| 51                                                                                                           |                                                                               |                                                                     |                                                     |                                                       |                                                     |                                                     |                                                     |
| COMPANY REFERENCES                                                                                           |                                                                               |                                                                     |                                                     | SUPPLIER REFERENCES                                   |                                                     |                                                     |                                                     |
|                                                                                                              |                                                                               |                                                                     |                                                     | Company :                                             |                                                     |                                                     |                                                     |
|                                                                                                              |                                                                               |                                                                     |                                                     | JOB N° :                                              |                                                     |                                                     |                                                     |

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|                                                                                                     |                                                                             | DATA SHEET                                     |                                               |                                         |                                                  |                                             |  |
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|                                                                                                                                                                                      |                                                                             | Main Project Title                             |                                               |                                         |                                                  | Page 4 of 7                                 |  |
| Issuing Dpt                                                                                                                                                                          | Rev. / Date                                                                 | 1/                                             | 2/                                            | 3/                                      | 4/                                               | 5/                                          |  |
| Written by :                                                                                                                                                                         |                                                                             |                                                |                                               |                                         |                                                  |                                             |  |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO ISO 10438-2 / API STD 614                                                                         |                                                                             |                                                |                                               |                                         | DS EP MEC 281                                    |                                             |  |
| <b>Annex B - Special-purpose oil system data sheets</b><br><b>Table B1 - Data sheet special-purpose oil system - SI units (continued)</b><br>Job No.:                      Item No.: |                                                                             |                                                |                                               |                                         |                                                  |                                             |  |
| 1                                                                                                                                                                                    | Applicable to                                                               | <input type="checkbox"/> Proposal              | <input type="checkbox"/> Purchase             | <input type="checkbox"/> As built       |                                                  |                                             |  |
| 2                                                                                                                                                                                    | Supplier                                                                    |                                                |                                               |                                         | Manufacturer                                     |                                             |  |
| 3                                                                                                                                                                                    | Purchase order No.                                                          | Date                                           |                                               | Inquiry No.                             | Requisition No.                                  |                                             |  |
| 4                                                                                                                                                                                    |                                                                             |                                                |                                               |                                         |                                                  |                                             |  |
| 5                                                                                                                                                                                    | <b>Coolers:</b>                                                             |                                                |                                               |                                         |                                                  |                                             |  |
| 6                                                                                                                                                                                    | Service application                                                         | <input type="radio"/> Lube                     | <input type="radio"/> Lube/seal               | <input type="radio"/> Separate seal oil |                                                  |                                             |  |
| 7                                                                                                                                                                                    | <input type="radio"/> Purchaser item Nos.                                   |                                                |                                               |                                         |                                                  |                                             |  |
| 8                                                                                                                                                                                    | <input type="radio"/> Tw in units                                           | <input type="checkbox"/>                       | <input type="checkbox"/>                      | <input type="checkbox"/>                |                                                  |                                             |  |
| 9                                                                                                                                                                                    | <input type="radio"/> Include option Nos.                                   |                                                |                                               |                                         |                                                  |                                             |  |
| 10                                                                                                                                                                                   | <input type="radio"/> Water side suitable for steam heating                 | <input type="checkbox"/>                       | <input type="checkbox"/>                      | <input type="checkbox"/>                |                                                  |                                             |  |
| 11                                                                                                                                                                                   | <input type="radio"/> Details on data sheet                                 |                                                |                                               |                                         |                                                  |                                             |  |
| 12                                                                                                                                                                                   | <input type="checkbox"/> Water side corrosion allowance                     |                                                |                                               |                                         |                                                  |                                             |  |
| 13                                                                                                                                                                                   | <input type="checkbox"/> Manufacturer                                       |                                                |                                               |                                         |                                                  |                                             |  |
| 14                                                                                                                                                                                   | <input type="checkbox"/> Model                                              |                                                |                                               |                                         |                                                  |                                             |  |
| 15                                                                                                                                                                                   | <input type="radio"/> TEMA class                                            |                                                |                                               |                                         |                                                  |                                             |  |
| 16                                                                                                                                                                                   | <input type="checkbox"/> Fouling factor w ater/oil-side                     |                                                |                                               |                                         |                                                  |                                             |  |
| 17                                                                                                                                                                                   | <input type="checkbox"/> Duty: J/h                                          |                                                |                                               |                                         |                                                  |                                             |  |
| 18                                                                                                                                                                                   | <input type="checkbox"/> Tube: L/OD/BWG                                     |                                                |                                               |                                         |                                                  |                                             |  |
| 19                                                                                                                                                                                   | <input type="checkbox"/> Design/test gauge pressure shell side (kPa)        |                                                |                                               |                                         |                                                  |                                             |  |
| 20                                                                                                                                                                                   | <input type="checkbox"/> Design/test gauge pressure tube side (kPa)         |                                                |                                               |                                         |                                                  |                                             |  |
| 21                                                                                                                                                                                   | <input type="radio"/> Code construction/stamp                               | <input type="radio"/> /                        | <input type="radio"/> /                       | <input type="radio"/> /                 |                                                  |                                             |  |
| 22                                                                                                                                                                                   | <input type="radio"/> Tw inplate frame or air coolers required              |                                                |                                               |                                         |                                                  |                                             |  |
| 23                                                                                                                                                                                   | <input type="radio"/> Connections for purchaser's cooler                    |                                                |                                               |                                         |                                                  |                                             |  |
| 24                                                                                                                                                                                   | <input type="checkbox"/> Tube water flow rate (m³/h)                        | /                                              | /                                             | /                                       |                                                  |                                             |  |
| 25                                                                                                                                                                                   | <input type="checkbox"/> Tube water velocity (m/s)                          |                                                |                                               |                                         |                                                  |                                             |  |
| 26                                                                                                                                                                                   | <input type="checkbox"/> Material: shell                                    |                                                |                                               |                                         |                                                  |                                             |  |
| 27                                                                                                                                                                                   | <input type="checkbox"/> Channels and covers                                |                                                |                                               |                                         |                                                  |                                             |  |
| 28                                                                                                                                                                                   | <input type="checkbox"/> Tube sheets and tubes                              |                                                |                                               |                                         |                                                  |                                             |  |
| 29                                                                                                                                                                                   | <input type="radio"/> Removable tube bundle                                 | <input type="checkbox"/>                       | <input type="checkbox"/>                      | <input type="checkbox"/>                |                                                  |                                             |  |
| 30                                                                                                                                                                                   | <input type="radio"/> U-bend tubes permitted                                | <input type="checkbox"/>                       | <input type="checkbox"/>                      | <input type="checkbox"/>                |                                                  |                                             |  |
| 31                                                                                                                                                                                   | <input type="radio"/> Fabricated with flanged vent and drain nozzles        | <input type="checkbox"/>                       | <input type="checkbox"/>                      | <input type="checkbox"/>                |                                                  |                                             |  |
| 32                                                                                                                                                                                   | <input type="radio"/> Oil side vents piped to reservoir through F           | <input type="checkbox"/>                       | <input type="checkbox"/>                      | <input type="checkbox"/>                |                                                  |                                             |  |
| 33                                                                                                                                                                                   | <input type="radio"/> Cooler drains manifolded with filter clean oil drains | <input type="checkbox"/>                       | <input type="checkbox"/>                      | <input type="checkbox"/>                |                                                  |                                             |  |
| 34                                                                                                                                                                                   | <input type="radio"/> Oil temperature control valve                         | <input type="checkbox"/>                       | <input type="checkbox"/>                      | <input type="checkbox"/>                |                                                  |                                             |  |
| 35                                                                                                                                                                                   | <input type="radio"/> 3 port valve with internal thermostat                 | <input type="checkbox"/>                       | <input type="checkbox"/>                      | <input type="checkbox"/>                |                                                  |                                             |  |
| 36                                                                                                                                                                                   | <input type="radio"/> Separate thermal relief valves, each cooler           | <input type="checkbox"/>                       | <input type="checkbox"/>                      | <input type="checkbox"/>                |                                                  |                                             |  |
| 37                                                                                                                                                                                   | <b>Continuous flow transfer valves:</b>                                     |                                                |                                               |                                         |                                                  |                                             |  |
| 38                                                                                                                                                                                   |                                                                             | <input type="radio"/> Lube oil                 | <input type="checkbox"/> Separate control oil | <input type="radio"/> Separate seal oil | <input type="radio"/> Booster pump discharge oil | <input type="radio"/> Separate coupling oil |  |
| 39                                                                                                                                                                                   | Service application                                                         | <input type="radio"/> Seal oil and Control oil |                                               |                                         |                                                  |                                             |  |
| 40                                                                                                                                                                                   |                                                                             |                                                |                                               |                                         |                                                  |                                             |  |
| 41                                                                                                                                                                                   | <input type="radio"/> Common for coolers and filters                        | <input type="checkbox"/>                       | <input type="checkbox"/>                      | <input type="checkbox"/>                | <input type="checkbox"/>                         | <input type="checkbox"/>                    |  |
| 42                                                                                                                                                                                   | <input type="radio"/> Tight shutoff required                                | <input type="checkbox"/>                       | <input type="checkbox"/>                      | <input type="checkbox"/>                | <input type="checkbox"/>                         | <input type="checkbox"/>                    |  |
| 43                                                                                                                                                                                   | <input type="radio"/> Type                                                  |                                                |                                               |                                         |                                                  |                                             |  |
| 44                                                                                                                                                                                   | <input type="checkbox"/> Manufacturer                                       |                                                |                                               |                                         |                                                  |                                             |  |
| 45                                                                                                                                                                                   | <input type="checkbox"/> Model                                              |                                                |                                               |                                         |                                                  |                                             |  |
| 46                                                                                                                                                                                   | <input type="checkbox"/> With lifting jack                                  | <input type="checkbox"/>                       | <input type="checkbox"/>                      | <input type="checkbox"/>                | <input type="checkbox"/>                         | <input type="checkbox"/>                    |  |
| 47                                                                                                                                                                                   | Rating: kPa                                                                 |                                                |                                               |                                         |                                                  |                                             |  |
| 48                                                                                                                                                                                   | <input type="checkbox"/> Materials: body                                    |                                                |                                               |                                         |                                                  |                                             |  |
| 49                                                                                                                                                                                   | <input type="checkbox"/> Plug or ball                                       |                                                |                                               |                                         |                                                  |                                             |  |
| 50                                                                                                                                                                                   | <input type="checkbox"/> Trim                                               |                                                |                                               |                                         |                                                  |                                             |  |
| 51                                                                                                                                                                                   |                                                                             |                                                |                                               |                                         |                                                  |                                             |  |
| COMPANY REFERENCES                                                                                                                                                                   |                                                                             |                                                | SUPPLIER REFERENCES                           |                                         |                                                  |                                             |  |
|                                                                                                                                                                                      |                                                                             |                                                | Company :                                     |                                         |                                                  |                                             |  |
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|                             |                                                             | DATA SHEET                                          |                                                     |                                                     |                                                     |    |
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|                                                                                                              |                                                             | Main Project Title                                  |                                                     |                                                     | Page 5 of 7                                         |    |
| Issuing Dpt                                                                                                  | Rev. / Date                                                 | 1/                                                  | 2/                                                  | 3/                                                  | 4/                                                  | 5/ |
| Written by :                                                                                                 |                                                             |                                                     |                                                     |                                                     |                                                     |    |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO ISO 10438-2 / API STD 614 |                                                             |                                                     |                                                     |                                                     | DS EP MEC 281                                       |    |
| Annex B - Special-purpose oil system data sheets                                                             |                                                             |                                                     |                                                     |                                                     |                                                     |    |
| Table B1 - Data sheet special-purpose oil system - SI units (continued)                                      |                                                             |                                                     |                                                     |                                                     |                                                     |    |
| Job No.:                                                                                                     |                                                             |                                                     |                                                     |                                                     | Item No.:                                           |    |
| 1                                                                                                            | Applicable to                                               | <input type="checkbox"/> Proposal                   | <input type="checkbox"/> Purchase                   | <input type="checkbox"/> As built                   |                                                     |    |
| 2                                                                                                            | Supplier                                                    |                                                     |                                                     |                                                     | Manufacturer                                        |    |
| 3                                                                                                            | Purchase order No.                                          | Date                                                |                                                     | Inquiry No.                                         | Requisition No.                                     |    |
| 4                                                                                                            |                                                             |                                                     |                                                     |                                                     |                                                     |    |
| 5                                                                                                            | <b>Accumulators:</b>                                        |                                                     |                                                     |                                                     |                                                     |    |
| 6                                                                                                            | Service application                                         | Lube oil                                            | Control oil                                         | Seal oil                                            | Seal-oil booster                                    |    |
| 7                                                                                                            | <input type="radio"/> Purchaser's item No.                  |                                                     |                                                     |                                                     |                                                     |    |
| 8                                                                                                            | <input type="checkbox"/> Required, yes or no, and quantity  |                                                     |                                                     |                                                     |                                                     |    |
| 9                                                                                                            | <input type="checkbox"/> Service combined with              |                                                     |                                                     |                                                     |                                                     |    |
| 10                                                                                                           | <input type="checkbox"/> Direct contact type                | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |    |
| 11                                                                                                           | <input type="checkbox"/> Bladder type                       | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |    |
| 12                                                                                                           | <input type="radio"/> Include option Nos.                   |                                                     |                                                     |                                                     |                                                     |    |
| 13                                                                                                           | <input type="radio"/> Rundown (min.)                        |                                                     |                                                     |                                                     |                                                     |    |
| 14                                                                                                           | <input type="radio"/> Oil temperature control               | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |    |
| 15                                                                                                           | <input type="radio"/> Constant pressure regulator           | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |    |
| 16                                                                                                           | <input type="checkbox"/> Manufacturer                       |                                                     |                                                     |                                                     |                                                     |    |
| 17                                                                                                           | <input type="checkbox"/> Model                              |                                                     |                                                     |                                                     |                                                     |    |
| 18                                                                                                           | <input type="checkbox"/> Nominal / usable capacity (litres) |                                                     |                                                     |                                                     |                                                     |    |
| 19                                                                                                           | <input type="radio"/> Material: shell                       |                                                     |                                                     |                                                     |                                                     |    |
| 20                                                                                                           | <input type="radio"/> Bladder                               |                                                     |                                                     |                                                     |                                                     |    |
| 21                                                                                                           | <input type="radio"/> Design/test gauge pressure (kPa)      |                                                     |                                                     |                                                     |                                                     |    |
| 22                                                                                                           | <input type="radio"/> Code construction/stamp               | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> |    |
| 23                                                                                                           | Include:                                                    |                                                     |                                                     |                                                     |                                                     |    |
| 24                                                                                                           | <input type="radio"/> charge pressure gauge                 | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |    |
| 25                                                                                                           | <input type="radio"/> Manual charge valve                   | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |    |
| 26                                                                                                           | <input type="radio"/> Gas supply regulator                  | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |    |
| 27                                                                                                           | <input type="radio"/> automatic vent and reset              | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |    |
| 28                                                                                                           |                                                             |                                                     |                                                     |                                                     |                                                     |    |
| 29                                                                                                           | <b>Overhead tanks (see Figures 2 and B.17)</b>              |                                                     |                                                     |                                                     |                                                     |    |
| 30                                                                                                           | Service application                                         | Rundown lube                                        | Low pressure seal                                   | Medium pressure seal                                | High pressure seal                                  |    |
| 31                                                                                                           | <input type="checkbox"/> Required, yes or no                |                                                     |                                                     |                                                     |                                                     |    |
| 32                                                                                                           | <input type="checkbox"/> Service combined with              |                                                     |                                                     |                                                     |                                                     |    |
| 33                                                                                                           | <input type="radio"/> Direct contact type                   | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |    |
| 34                                                                                                           | <input type="radio"/> Bladder type                          | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |    |
| 35                                                                                                           | <input type="radio"/> Include options No.                   |                                                     |                                                     |                                                     |                                                     |    |
| 36                                                                                                           | <input type="checkbox"/> Time at flow rate (min)            |                                                     |                                                     |                                                     |                                                     |    |
| 37                                                                                                           | <input type="checkbox"/> Capacity (litres)                  |                                                     |                                                     |                                                     |                                                     |    |
| 38                                                                                                           | <input type="radio"/> Blow down connection                  |                                                     |                                                     |                                                     |                                                     |    |
| 39                                                                                                           |                                                             |                                                     |                                                     |                                                     |                                                     |    |
| 40                                                                                                           | <b>Rundown tanks (see Figures B.15, B.16)</b>               |                                                     |                                                     |                                                     |                                                     |    |
| 41                                                                                                           | <b>Overhead tanks (see Figures 2 and B.17)</b>              |                                                     |                                                     |                                                     |                                                     |    |
| 42                                                                                                           | <input type="radio"/> Corrosion allowance                   |                                                     |                                                     |                                                     |                                                     |    |
| 43                                                                                                           | <input type="checkbox"/> Material                           |                                                     |                                                     |                                                     |                                                     |    |
| 44                                                                                                           | <input type="checkbox"/> Total capacity (litres)            |                                                     |                                                     |                                                     |                                                     |    |
| 45                                                                                                           | <input type="checkbox"/> Design / test pressure (kPa)       |                                                     |                                                     |                                                     |                                                     |    |
| 46                                                                                                           | <input type="radio"/> Additional coastdown time (min)       | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |    |
| 47                                                                                                           | <input type="radio"/> Valved blow down connection           | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |    |
| 48                                                                                                           | <input type="radio"/> Code construction                     | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |    |
| 49                                                                                                           | <input type="radio"/> Code stamp                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            | <input type="checkbox"/>                            |    |
| 50                                                                                                           | <input type="radio"/> MPI testing                           |                                                     |                                                     |                                                     |                                                     |    |
| 51                                                                                                           |                                                             |                                                     |                                                     |                                                     |                                                     |    |
| Column blank for revision number (X)                                                                         |                                                             |                                                     |                                                     |                                                     |                                                     |    |
| COMPANY REFERENCES                                                                                           |                                                             |                                                     |                                                     | SUPPLIER REFERENCES                                 |                                                     |    |
|                                                                                                              |                                                             |                                                     |                                                     | Company :                                           |                                                     |    |
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|                             |                                                             | DATA SHEET                                          |                                                     |                                                     |                                                     |    |
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| Issuing Dpt                                                                                                  | Rev. / Date                                                 | 1/                                                  | 2/                                                  | 3/                                                  | 4/                                                  | 5/ |
| Written by :                                                                                                 |                                                             |                                                     |                                                     |                                                     |                                                     |    |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO ISO 10438-2 / API STD 614 |                                                             |                                                     |                                                     |                                                     | DS EP MEC 281                                       |    |
| Annex B- Special-purpose oil system data sheets                                                              |                                                             |                                                     |                                                     |                                                     |                                                     |    |
| Table B1 - Data sheet special-purpose oil system - SI units (continued)                                      |                                                             |                                                     |                                                     |                                                     |                                                     |    |
| Job No.:                                                                                                     |                                                             | Item No.:                                           |                                                     |                                                     |                                                     |    |
| 1                                                                                                            | Applicable to                                               | <input type="checkbox"/> Proposal                   | <input type="checkbox"/> Purchase                   | <input type="checkbox"/> As built                   |                                                     |    |
| 2                                                                                                            | Supplier                                                    | Manufacturer                                        |                                                     |                                                     |                                                     |    |
| 3                                                                                                            | Purchase order No.                                          | Date                                                | Inquiry No.                                         | Requisition No.                                     |                                                     |    |
| 4                                                                                                            |                                                             |                                                     |                                                     |                                                     |                                                     |    |
| 5                                                                                                            | Accumulator unit (see Figures B.18 and B.19)                | Rundown lube                                        | Low pressure seal                                   | Medium pressure seal                                | High pressure seal                                  |    |
| 6                                                                                                            |                                                             |                                                     |                                                     |                                                     |                                                     |    |
| 7                                                                                                            | <input type="radio"/> Purchaser item No.                    |                                                     |                                                     |                                                     |                                                     |    |
| 8                                                                                                            | <input type="radio"/> Corrosion allowance (mm)              |                                                     |                                                     |                                                     |                                                     |    |
| 9                                                                                                            | <input type="radio"/> Quantity                              |                                                     |                                                     |                                                     |                                                     |    |
| 10                                                                                                           | <input type="radio"/> Manufacturer                          |                                                     |                                                     |                                                     |                                                     |    |
| 11                                                                                                           | <input type="radio"/> Model                                 |                                                     |                                                     |                                                     |                                                     |    |
| 12                                                                                                           | <input type="radio"/> Material: shell                       |                                                     |                                                     |                                                     |                                                     |    |
| 13                                                                                                           | <input type="radio"/> Bladder                               |                                                     |                                                     |                                                     |                                                     |    |
| 14                                                                                                           | <input type="checkbox"/> Nominal / usable capacity (litres) |                                                     |                                                     |                                                     |                                                     |    |
| 15                                                                                                           | <input type="radio"/> Design/test gauge pressure (kPa)      |                                                     |                                                     |                                                     |                                                     |    |
| 16                                                                                                           | <input type="radio"/> Code construction/stamp               | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> |    |
| 17                                                                                                           | Traps for inner seal oil: (oil seals)                       |                                                     |                                                     |                                                     |                                                     |    |
| 18                                                                                                           | Service application                                         |                                                     |                                                     |                                                     |                                                     |    |
| 19                                                                                                           | <input type="radio"/> Purchaser item No.                    |                                                     |                                                     |                                                     |                                                     |    |
| 20                                                                                                           | <input type="radio"/> Seat-gas vent piping arrangement      |                                                     |                                                     |                                                     |                                                     |    |
| 21                                                                                                           | <input type="radio"/> Drain piped to be specified location  |                                                     |                                                     |                                                     |                                                     |    |
| 22                                                                                                           | <input type="radio"/> each drain piped separately           |                                                     |                                                     |                                                     |                                                     |    |
| 23                                                                                                           | <input type="radio"/> Float controlled                      | <input type="checkbox"/>                            |                                                     |                                                     |                                                     |    |
| 24                                                                                                           | <input type="radio"/> Transmitter controlled                | <input type="checkbox"/>                            |                                                     |                                                     |                                                     |    |
| 25                                                                                                           | <input type="radio"/> Pots only: for manual drain           | <input type="checkbox"/>                            |                                                     |                                                     |                                                     |    |
| 26                                                                                                           | <input type="radio"/> with: valving                         | <input type="checkbox"/>                            |                                                     |                                                     |                                                     |    |
| 27                                                                                                           | <input type="radio"/> Flush level glass                     | <input type="checkbox"/>                            |                                                     |                                                     |                                                     |    |
| 28                                                                                                           | <input type="radio"/> High level switch                     | <input type="checkbox"/>                            |                                                     |                                                     |                                                     |    |
| 29                                                                                                           | <input type="radio"/> Include option Nos.                   |                                                     |                                                     |                                                     |                                                     |    |
| 30                                                                                                           | <input type="radio"/> Retention: (hr/litres)                |                                                     |                                                     |                                                     |                                                     |    |
| 31                                                                                                           | <input type="radio"/> Code construction/stamp               | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> |    |
| 32                                                                                                           | Float trap                                                  |                                                     |                                                     |                                                     |                                                     |    |
| 33                                                                                                           | <input type="radio"/> Manufacturer/model                    |                                                     |                                                     |                                                     |                                                     |    |
| 34                                                                                                           | <input type="radio"/> Model                                 |                                                     |                                                     |                                                     |                                                     |    |
| 35                                                                                                           | <input type="radio"/> Pressure rating (kPa)                 |                                                     |                                                     |                                                     |                                                     |    |
| 36                                                                                                           | <input type="radio"/> Materials: body                       |                                                     |                                                     |                                                     |                                                     |    |
| 37                                                                                                           | <input type="radio"/> Float / trim                          |                                                     |                                                     |                                                     |                                                     |    |
| 38                                                                                                           | <input type="radio"/> Drain line piped to:                  |                                                     |                                                     |                                                     |                                                     |    |
| 39                                                                                                           | <input type="radio"/> Code construction/stamp               | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> |    |
| 40                                                                                                           | Drain pot                                                   |                                                     |                                                     |                                                     |                                                     |    |
| 41                                                                                                           | <input type="radio"/> Corrosion allowance                   |                                                     |                                                     |                                                     |                                                     |    |
| 42                                                                                                           | <input type="radio"/> Material                              |                                                     |                                                     |                                                     |                                                     |    |
| 43                                                                                                           | <input type="radio"/> Design / test pressure                |                                                     |                                                     |                                                     |                                                     |    |
| 44                                                                                                           | <input type="radio"/> Code construction/stamp               | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> |    |
| 45                                                                                                           | Mist eliminator                                             |                                                     |                                                     |                                                     |                                                     |    |
| 46                                                                                                           | <input type="radio"/> Corrosion allowance (mm)              |                                                     |                                                     |                                                     |                                                     |    |
| 47                                                                                                           | <input type="radio"/> Material: shell                       |                                                     |                                                     |                                                     |                                                     |    |
| 48                                                                                                           | <input type="radio"/> Demisting mesh                        |                                                     |                                                     |                                                     |                                                     |    |
| 49                                                                                                           | <input type="radio"/> Design / test pressure (kPa)          |                                                     |                                                     |                                                     |                                                     |    |
| 50                                                                                                           | <input type="radio"/> Code construction/stamp               | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> | <input type="checkbox"/> / <input type="checkbox"/> |    |
| 51                                                                                                           |                                                             |                                                     |                                                     |                                                     |                                                     |    |
| COMPANY REFERENCES                                                                                           |                                                             |                                                     | SUPPLIER REFERENCES                                 |                                                     |                                                     |    |
|                                                                                                              |                                                             |                                                     | Company :                                           |                                                     |                                                     |    |
|                                                                                                              |                                                             |                                                     | JOB N° :                                            |                                                     |                                                     |    |

Column blank for revision number (X)



## General Specification

**GS EP MEC 281**

Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries  
according to ISO 10438 / API Standard 614

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|                                                                                                                                                                   |             | DATA SHEET         |    |    |                                      |                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------|----|----|--------------------------------------|--------------------------|
|                                                                                                                                                                   |             | Main Project Title |    |    | Page 7 of 7                          |                          |
| Issuing Dpt                                                                                                                                                       | Rev. / Date | 1/                 | 2/ | 3/ | 4/                                   | 5/                       |
| Written by :                                                                                                                                                      |             |                    |    |    |                                      |                          |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO ISO 10438-2 / API STD 614                                                      |             |                    |    |    | DS EP MEC 281                        |                          |
| Annex B - Special-purpose oil system data sheets                                                                                                                  |             |                    |    |    |                                      |                          |
| Table B1 - Data sheet special-purpose oil system - SI units (continued)                                                                                           |             |                    |    |    |                                      |                          |
| Job No.:                                                                                                                                                          |             |                    |    |    | Item No.:                            |                          |
| 1 <input type="checkbox"/> Applicable to <input type="checkbox"/> Proposal <input type="checkbox"/> Purchase <input type="checkbox"/> As built                    |             |                    |    |    |                                      |                          |
| 2 Supplier                                                                                                                                                        |             |                    |    |    | Manufacturer                         |                          |
| 3 Purchase order No.                                                                                                                                              |             | Date               |    |    | Inquiry No. Requisition No.          |                          |
| 4                                                                                                                                                                 |             |                    |    |    |                                      |                          |
| 5 Shop inspection ISO 10438-1/API 614                                                                                                                             |             |                    |    |    | Required                             | Witness                  |
| 6 <input type="checkbox"/> Compliance with inspector's checklist                                                                                                  |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 7 <input type="checkbox"/> Required for system assemblies                                                                                                         |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 8 <input type="checkbox"/> Cleanliness prior to closure                                                                                                           |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 9 <input type="checkbox"/> Required for major components                                                                                                          |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 10 <input type="checkbox"/> Material certifications to be furnished                                                                                               |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 11 <input type="checkbox"/> Special examinations                                                                                                                  |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 12 <input type="checkbox"/> Code construction/stamp                                                                                                               |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 13 <input type="checkbox"/> Code stamp                                                                                                                            |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 14 <input type="checkbox"/> Certified copies of all testlogs and data                                                                                             |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 15 <input type="checkbox"/> PMI testing                                                                                                                           |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 16 <input type="checkbox"/> Hardness testing                                                                                                                      |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 17 <input type="checkbox"/>                                                                                                                                       |             |                    |    |    |                                      |                          |
| 18 <input type="checkbox"/>                                                                                                                                       |             |                    |    |    |                                      |                          |
| 19 Shop test ISO 10438-1/API 614                                                                                                                                  |             |                    |    |    | Required                             | Witness                  |
| 20 <input type="checkbox"/> Cleanliness                                                                                                                           |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 21 <input type="checkbox"/> Four hour run                                                                                                                         |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 22 <input type="checkbox"/> Check controls                                                                                                                        |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 23 <input type="checkbox"/> Changeover filters / coders                                                                                                           |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 24 <input type="checkbox"/> One and two pump operation                                                                                                            |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 25 <input type="checkbox"/> Sound level                                                                                                                           |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 26 <input type="checkbox"/> Hydro test assembled system                                                                                                           |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 27 <input type="checkbox"/> Use during shop test of equipment                                                                                                     |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 28 <input type="checkbox"/> Use for complete unit system test                                                                                                     |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 29 <input type="checkbox"/> Certified copies of all test logs and data                                                                                            |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 30 <input type="checkbox"/> Submit prior to shipment                                                                                                              |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 31 <input type="checkbox"/> Demonstrate pump alignment by unbolting pump inlet and discharge piping                                                               |             |                    |    |    | <input type="checkbox"/>             | <input type="checkbox"/> |
| 32 <input type="checkbox"/>                                                                                                                                       |             |                    |    |    |                                      |                          |
| 33 <input type="checkbox"/> Amount of advance notification required before a witnessed or observed inspection                                                     |             |                    |    |    |                                      |                          |
| 34 <input type="checkbox"/> Records or data to be kept by vendor for at least 20 years, in addition to the requirements of ISO 10438-1                            |             |                    |    |    |                                      |                          |
| 35 <input type="checkbox"/> Surface and subsurface examination required Examination type                                                                          |             |                    |    |    |                                      |                          |
| 36 <input type="checkbox"/> magnetic particle <input type="checkbox"/> liquid penetrant <input type="checkbox"/> radiographic <input type="checkbox"/> ultrasonic |             |                    |    |    |                                      |                          |
| 37 <input type="checkbox"/> One copy of manufacturer's standard instruction manual packed and shipped with equipment                                              |             |                    |    |    |                                      |                          |
| 38 Remarks                                                                                                                                                        |             |                    |    |    |                                      |                          |
| 39                                                                                                                                                                |             |                    |    |    |                                      |                          |
| 40                                                                                                                                                                |             |                    |    |    |                                      |                          |
| 41                                                                                                                                                                |             |                    |    |    |                                      |                          |
| 42                                                                                                                                                                |             |                    |    |    |                                      |                          |
| 43                                                                                                                                                                |             |                    |    |    |                                      |                          |
| 44                                                                                                                                                                |             |                    |    |    |                                      |                          |
| 45                                                                                                                                                                |             |                    |    |    |                                      |                          |
| 46                                                                                                                                                                |             |                    |    |    |                                      |                          |
| 47                                                                                                                                                                |             |                    |    |    |                                      |                          |
| 48                                                                                                                                                                |             |                    |    |    |                                      |                          |
| 49                                                                                                                                                                |             |                    |    |    |                                      |                          |
| 50                                                                                                                                                                |             |                    |    |    |                                      |                          |
| 51                                                                                                                                                                |             |                    |    |    |                                      |                          |
| COMPANY REFERENCES                                                                                                                                                |             |                    |    |    | Column blank for revision number (X) |                          |
| SUPPLIER REFERENCES                                                                                                                                               |             |                    |    |    | Company :                            |                          |



| General Specification                                                                                            |                         | GS EP MEC 281    |
|------------------------------------------------------------------------------------------------------------------|-------------------------|------------------|
| Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries<br>according to ISO 10438 / API Standard 614 |                         |                  |
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## Datasheet **ISO 10438-3**



# General Specification

GS EP MEC 281

Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries  
according to ISO 10438 / API Standard 614

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|                                                                                                              |                                                                                                                                                                    | DATA SHEET                                                                       |                                                                               |                                   |                                                                                    |                 |  |
|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------|------------------------------------------------------------------------------------|-----------------|--|
|                                                                                                              |                                                                                                                                                                    | Main Project Title                                                               |                                                                               |                                   |                                                                                    | Page 1 of 4     |  |
| Issuing Dpt                                                                                                  | Rev. / Date                                                                                                                                                        | 1/                                                                               | 2/                                                                            | 3/                                | 4/                                                                                 | 5/              |  |
| Written by :                                                                                                 |                                                                                                                                                                    |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO ISO 10438-3 / API STD 614 |                                                                                                                                                                    |                                                                                  |                                                                               |                                   | DS EP MEC 281                                                                      |                 |  |
| Annex B - General-purpose oil system data sheets                                                             |                                                                                                                                                                    |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| Table B1 - Data sheet general-purpose oil system - SI units                                                  |                                                                                                                                                                    |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| Job No.:                                                                                                     |                                                                                                                                                                    |                                                                                  |                                                                               |                                   | Item No.:                                                                          |                 |  |
| 1                                                                                                            | Applicable to                                                                                                                                                      | <input type="checkbox"/> Proposal <input checked="" type="checkbox"/> Purchase   |                                                                               | <input type="checkbox"/> As built |                                                                                    |                 |  |
| 2                                                                                                            | For                                                                                                                                                                |                                                                                  |                                                                               | Site                              |                                                                                    |                 |  |
| 3                                                                                                            | Oil system for                                                                                                                                                     |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 4                                                                                                            | Supplier                                                                                                                                                           |                                                                                  |                                                                               | Manufacturer                      |                                                                                    |                 |  |
| 5                                                                                                            | Purchase order No.                                                                                                                                                 | Date                                                                             |                                                                               | Inquiry No.                       |                                                                                    | Requisition No. |  |
| 6                                                                                                            |                                                                                                                                                                    |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 7                                                                                                            | Explanations:                                                                                                                                                      |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 8                                                                                                            | - The party to complete the information is indicated as follow s:                                                                                                  |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 9                                                                                                            | <input type="radio"/> Purchaser <input type="checkbox"/> Vendor <input type="checkbox"/> Either, but by vendor if not by purchaser                                 |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 10                                                                                                           | - An asterisk * specifies a requirement, value or criterion.                                                                                                       |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 11                                                                                                           | - Designations in parentheses ( ) are: explained in the cited standard; those prefixed "T" are text figure numbers; those prefixed "A" are Annex A figure numbers. |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 12                                                                                                           |                                                                                                                                                                    |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 13                                                                                                           | - For definition of general-purpose basic system, see Clause 4                                                                                                     |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 14                                                                                                           | Basic Design                                                                                                                                                       | Class <input type="radio"/> I <input type="radio"/> II <input type="radio"/> III |                                                                               | Code                              |                                                                                    |                 |  |
| 15                                                                                                           | Design goal for uninterrupted operation (mission time) of the equipment months                                                                                     |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 16                                                                                                           |                                                                                                                                                                    |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 17                                                                                                           | Overall system typical schemas                                                                                                                                     | Figure No.                                                                       |                                                                               | Option Nos.                       |                                                                                    | Comment         |  |
| 18                                                                                                           | <input type="radio"/> Basic oil supply module                                                                                                                      |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 19                                                                                                           | <input type="radio"/> Lube module at equipment                                                                                                                     |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 20                                                                                                           | <input type="radio"/> Drawing requirement                                                                                                                          |                                                                                  | <input type="radio"/> Component review                                        |                                   |                                                                                    |                 |  |
| 21                                                                                                           | Oil requirements: See ISO 10438-1/API 614 data sheet                                                                                                               |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 22                                                                                                           | Baseplate/layout:                                                                                                                                                  |                                                                                  | <input type="checkbox"/> Combined with equipment base                         |                                   |                                                                                    |                 |  |
| 23                                                                                                           | <input type="radio"/> Grout hole/vent holes                                                                                                                        |                                                                                  | <input type="radio"/> Point support                                           |                                   |                                                                                    |                 |  |
| 24                                                                                                           | <input type="radio"/> Epoxy grout/primer pre-coat                                                                                                                  |                                                                                  | <input type="radio"/> m minimum clearance for components                      |                                   |                                                                                    |                 |  |
| 25                                                                                                           | <input type="radio"/> Sloped decking required                                                                                                                      |                                                                                  | <input type="radio"/> Non skid decking required                               |                                   |                                                                                    |                 |  |
| 26                                                                                                           | Basic system details:                                                                                                                                              |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 27                                                                                                           | <input type="checkbox"/> Equipment coast-down time                                                                                                                 |                                                                                  | min                                                                           |                                   | <input checked="" type="radio"/> Shop test conditions                              |                 |  |
| 28                                                                                                           | <input type="checkbox"/> Minimum start-up oil temperature                                                                                                          |                                                                                  | °C                                                                            |                                   | <input checked="" type="radio"/> Field start-up/run-in conditions                  |                 |  |
| 29                                                                                                           | <input checked="" type="radio"/> Sound level                                                                                                                       |                                                                                  | 85 dBA max.                                                                   |                                   | <input checked="" type="radio"/> Welding and special fabrication requirements      |                 |  |
| 30                                                                                                           | Special provisions necessary for back-up supply of the lube oil                                                                                                    |                                                                                  | <input checked="" type="checkbox"/> Standby pump                              |                                   | <input checked="" type="checkbox"/> Rndown n tank                                  |                 |  |
| 31                                                                                                           | Components:                                                                                                                                                        |                                                                                  | <input type="radio"/> All steel external components                           |                                   |                                                                                    |                 |  |
| 32                                                                                                           | Piping and tubing:                                                                                                                                                 |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 33                                                                                                           | <input checked="" type="checkbox"/> Tubing fittings                                                                                                                |                                                                                  | Mfg. Model                                                                    |                                   | <input checked="" type="radio"/> Additional special requirements see GS EP MEC 281 |                 |  |
| 34                                                                                                           | <input checked="" type="radio"/> Carbon steel slip-on flanges not allowed (ISO 10438-1:2003, Table 1)                                                              |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 35                                                                                                           | <input type="radio"/> Through studs required                                                                                                                       |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 36                                                                                                           | <input checked="" type="radio"/> Heat tracing required by                                                                                                          |                                                                                  | <input type="checkbox"/> Purchaser <input checked="" type="checkbox"/> Vendor |                                   | <input checked="" type="radio"/> Utilities manifolded to common connections        |                 |  |
| 37                                                                                                           | <input checked="" type="radio"/> Valve heads vented to reservoir                                                                                                   |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 38                                                                                                           | <input checked="" type="radio"/> Radiographic examination                                                                                                          |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 39                                                                                                           |                                                                                                                                                                    |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 40                                                                                                           | Continuous flow transfer valves                                                                                                                                    |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 41                                                                                                           | <input checked="" type="radio"/> Separate for coolers and filters                                                                                                  |                                                                                  | <input type="checkbox"/> With lifting jack required                           |                                   |                                                                                    |                 |  |
| 42                                                                                                           | <input checked="" type="radio"/> Tight shutoff required                                                                                                            |                                                                                  | Rating: kPa                                                                   |                                   |                                                                                    |                 |  |
| 43                                                                                                           | <input type="radio"/> Type                                                                                                                                         |                                                                                  | <input type="checkbox"/> Materials: body 316 SS                               |                                   |                                                                                    |                 |  |
| 44                                                                                                           | <input checked="" type="radio"/> Spectacle blinds provided                                                                                                         |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 45                                                                                                           | <input type="checkbox"/> Manufacturer                                                                                                                              |                                                                                  | <input type="checkbox"/> Plug or ball 316 SS                                  |                                   |                                                                                    |                 |  |
| 46                                                                                                           | <input type="checkbox"/> Model                                                                                                                                     |                                                                                  | <input type="checkbox"/> Trim 316 SS                                          |                                   |                                                                                    |                 |  |
| 47                                                                                                           |                                                                                                                                                                    |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 48                                                                                                           |                                                                                                                                                                    |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 49                                                                                                           |                                                                                                                                                                    |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 50                                                                                                           |                                                                                                                                                                    |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| 51                                                                                                           |                                                                                                                                                                    |                                                                                  |                                                                               |                                   |                                                                                    |                 |  |
| COMPANY REFERENCES                                                                                           |                                                                                                                                                                    |                                                                                  | SUPPLIER REFERENCES                                                           |                                   |                                                                                    |                 |  |
|                                                                                                              |                                                                                                                                                                    |                                                                                  | Company :                                                                     |                                   |                                                                                    |                 |  |
|                                                                                                              |                                                                                                                                                                    |                                                                                  | JOB N° :                                                                      |                                   |                                                                                    |                 |  |

|                             |                                                                                                              | DATA SHEET                                                                                                           |    |                     |               |                                   |
|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|----|---------------------|---------------|-----------------------------------|
|                                                                                                              |                                                                                                              | Main Project Title                                                                                                   |    |                     | Page 2 of 4   |                                   |
| Issuing Dpt                                                                                                  | Rev. / Date                                                                                                  | 1/                                                                                                                   | 2/ | 3/                  | 4/            | 5/                                |
|                                                                                                              | Written by :                                                                                                 |                                                                                                                      |    |                     |               |                                   |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO ISO 10438-3 / API STD 614 |                                                                                                              |                                                                                                                      |    |                     | DS EP MEC 281 |                                   |
| Annex B - General-purpose oil system data sheets                                                             |                                                                                                              |                                                                                                                      |    |                     |               |                                   |
| Table B1 - Data sheet general-purpose oil system - SI units (continued)                                      |                                                                                                              |                                                                                                                      |    |                     |               |                                   |
|                                                                                                              |                                                                                                              | Job No.:                                                                                                             |    |                     |               | Item No.:                         |
| 1                                                                                                            | Applicable to                                                                                                | <input type="checkbox"/> Proposal <input type="checkbox"/> Purchase                                                  |    | Site                |               | <input type="checkbox"/> As built |
| 2                                                                                                            | For                                                                                                          |                                                                                                                      |    |                     |               |                                   |
| 3                                                                                                            | Oil system for                                                                                               |                                                                                                                      |    |                     |               |                                   |
| 4                                                                                                            | Supplier                                                                                                     |                                                                                                                      |    | Manufacturer        |               |                                   |
| 5                                                                                                            | Purchase order No.                                                                                           | Date                                                                                                                 |    | Inquiry No.         |               | Requisition No.                   |
| 6                                                                                                            |                                                                                                              |                                                                                                                      |    |                     |               |                                   |
| 7                                                                                                            | Oil conditioners (if required)                                                                               |                                                                                                                      |    |                     |               |                                   |
| 8                                                                                                            | <input type="radio"/> Purchaser's item No.                                                                   | <input type="checkbox"/> Driver for                                                                                  |    |                     |               |                                   |
| 9                                                                                                            | <input type="radio"/> Type                                                                                   | <input type="checkbox"/> kw and enclosure                                                                            |    |                     |               |                                   |
| 10                                                                                                           | <input type="radio"/> Portable or mounted on                                                                 | <input type="checkbox"/> Volts/phase (single or 3-phase)/Hz                                                          |    |                     |               |                                   |
| 11                                                                                                           | <input type="checkbox"/> Rated m <sup>3</sup> /h of oil                                                      |                                                                                                                      |    |                     |               |                                   |
| 12                                                                                                           | <input type="checkbox"/> Manufacturer                                                                        |                                                                                                                      |    |                     |               |                                   |
| 13                                                                                                           | <input type="checkbox"/> Model                                                                               | <input type="checkbox"/> Water removable rate                                                                        |    |                     |               |                                   |
|                                                                                                              |                                                                                                              | <input type="checkbox"/> Material of construction                                                                    |    |                     |               |                                   |
| 14                                                                                                           | Reservoir                                                                                                    | Pumps and drivers                                                                                                    |    |                     |               |                                   |
| 15                                                                                                           | <input type="radio"/> Figure Nos.                                                                            | <input type="radio"/> Purchaser item Nos.                                                                            |    |                     |               |                                   |
| 16                                                                                                           | <input type="radio"/> Include option Nos.                                                                    | <input type="radio"/> Full details on data sheet                                                                     |    |                     |               |                                   |
| 17                                                                                                           | <input checked="" type="radio"/> Electric heater <input checked="" type="radio"/> Removable during operation | Pump type and material                                                                                               |    |                     |               |                                   |
| 18                                                                                                           | <input type="radio"/> Special heater sizing                                                                  | <input type="radio"/> Supplier standard                                                                              |    |                     |               |                                   |
| 19                                                                                                           | <input checked="" type="radio"/> Oil level glass                                                             | <input type="radio"/> Centrifugal <input type="radio"/> horizontal <input type="radio"/> vertical                    |    |                     |               |                                   |
| 20                                                                                                           | <input checked="" type="radio"/> Low -level alarm                                                            | <input type="radio"/> ISO 13709 <input type="radio"/> ANSI/ASME B73.2/ASME B73.3                                     |    |                     |               |                                   |
| 21                                                                                                           | <input type="radio"/> 50-mm fill opening                                                                     | <input type="radio"/> Rotary positive displacement                                                                   |    |                     |               |                                   |
| 22                                                                                                           | <input type="radio"/> Sloped bottom with mow point drain                                                     | <input type="radio"/> API RP 676                                                                                     |    |                     |               |                                   |
| 23                                                                                                           | <input type="radio"/> Free surface (m <sup>2</sup> )                                                         | <input type="radio"/> Submerged                                                                                      |    |                     |               |                                   |
| 24                                                                                                           | <input type="checkbox"/> Working capacity (min/l)                                                            | <input checked="" type="radio"/> Steel casing                                                                        |    |                     |               |                                   |
| 25                                                                                                           | <input type="checkbox"/> Retention capacity (min/l)                                                          | <input type="radio"/> In-line                                                                                        |    |                     |               |                                   |
| 26                                                                                                           | <input type="checkbox"/> Rundu n capacity                                                                    | Pump quantity and driver(s)                                                                                          |    |                     |               |                                   |
| 27                                                                                                           | <input type="checkbox"/> Normal operating range                                                              | <input type="radio"/> Single-shaft driven                                                                            |    |                     |               |                                   |
| 28                                                                                                           | <input type="checkbox"/> Charge capacity                                                                     | <input type="radio"/> Single-motor driven                                                                            |    |                     |               |                                   |
| 29                                                                                                           | <input checked="" type="radio"/> Insulation clips                                                            | <input type="checkbox"/> Motor driven start-up with shaft drive main                                                 |    |                     |               |                                   |
| 30                                                                                                           | <input checked="" type="radio"/> Ladder with handrail                                                        | <input type="checkbox"/> Full-sized motor-driven start-up to double as auxiliary pump                                |    |                     |               |                                   |
| 31                                                                                                           | <input checked="" type="radio"/> Handrails on top                                                            | <input type="radio"/> Dual motor drive                                                                               |    |                     |               |                                   |
| 32                                                                                                           | <input checked="" type="radio"/> Non-skid decking                                                            | <input type="radio"/> Dual steam turbine main/motor aux.                                                             |    |                     |               |                                   |
| 33                                                                                                           | <input checked="" type="radio"/> Flanged vent                                                                | <input type="radio"/> Motors per                                                                                     |    |                     |               |                                   |
| 34                                                                                                           | <input checked="" type="radio"/> Flanged drain connections                                                   | <input checked="" type="radio"/> IEC <input type="radio"/> NEMA <input checked="" type="radio"/> Other GS EP ELE 111 |    |                     |               |                                   |
| 35                                                                                                           | <input type="radio"/> Extra connection                                                                       | Pump installation                                                                                                    |    |                     |               |                                   |
| 36                                                                                                           | <input checked="" type="radio"/> Siphon breaker                                                              | <input checked="" type="radio"/> Removable strainer                                                                  |    |                     |               |                                   |
| 37                                                                                                           | <input type="radio"/> Top mounted components permitted                                                       | <input checked="" type="radio"/> Mounting pads                                                                       |    |                     |               |                                   |
| 38                                                                                                           | <input type="checkbox"/> Top mounted components are:                                                         | <input checked="" type="radio"/> Jackscrews provided for pump driver                                                 |    |                     |               |                                   |
| 39                                                                                                           | <input type="checkbox"/> Submerged components and materials                                                  |                                                                                                                      |    |                     |               |                                   |
| 40                                                                                                           | <input type="checkbox"/> Dimensions of tank L (m) x W (m) x H (m)                                            |                                                                                                                      |    |                     |               |                                   |
| 41                                                                                                           |                                                                                                              |                                                                                                                      |    |                     |               |                                   |
| 42                                                                                                           |                                                                                                              |                                                                                                                      |    |                     |               |                                   |
| 43                                                                                                           |                                                                                                              |                                                                                                                      |    |                     |               |                                   |
| 44                                                                                                           |                                                                                                              |                                                                                                                      |    |                     |               |                                   |
| 45                                                                                                           |                                                                                                              |                                                                                                                      |    |                     |               |                                   |
| 46                                                                                                           |                                                                                                              |                                                                                                                      |    |                     |               |                                   |
| 47                                                                                                           |                                                                                                              |                                                                                                                      |    |                     |               |                                   |
| 48                                                                                                           |                                                                                                              |                                                                                                                      |    |                     |               |                                   |
| 49                                                                                                           |                                                                                                              |                                                                                                                      |    |                     |               |                                   |
| 50                                                                                                           |                                                                                                              |                                                                                                                      |    |                     |               |                                   |
| COMPANY REFERENCES                                                                                           |                                                                                                              |                                                                                                                      |    | SUPPLIER REFERENCES |               |                                   |
| Company :                                                                                                    |                                                                                                              |                                                                                                                      |    | Company :           |               |                                   |
| JOB N° :                                                                                                     |                                                                                                              |                                                                                                                      |    | JOB N° :            |               |                                   |

Column blank for revision number (X)

Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries  
according to ISO 10438 / API Standard 614

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|                             |                                                                              | DATA SHEET                                                             |                                                                             |                                                               |                                                    |                 |
|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------------------|-----------------|
|                                                                                                              |                                                                              | Main Project Title                                                     |                                                                             |                                                               |                                                    |                 |
| Issuing Dpt                                                                                                  |                                                                              | Rev. / Date                                                            | 1/                                                                          | 2/                                                            | 3/                                                 | 4/              |
| Written by :                                                                                                 |                                                                              |                                                                        |                                                                             |                                                               |                                                    |                 |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO ISO 10438-3 / API STD 614 |                                                                              |                                                                        |                                                                             |                                                               | DS EP MEC 281                                      |                 |
| Annex B - General-purpose oil system data sheets                                                             |                                                                              |                                                                        |                                                                             |                                                               |                                                    |                 |
| Table B1 - Data sheet general-purpose oil system - SI units (continued)                                      |                                                                              |                                                                        |                                                                             |                                                               |                                                    |                 |
| Job No.:      Item No.:                                                                                      |                                                                              |                                                                        |                                                                             |                                                               |                                                    |                 |
| 1                                                                                                            | Applicable to                                                                | <input type="checkbox"/> Proposal                                      | <input type="checkbox"/> Purchase                                           | Site                                                          |                                                    |                 |
| 2                                                                                                            | For                                                                          |                                                                        |                                                                             |                                                               | <input type="checkbox"/> As built                  |                 |
| 3                                                                                                            | Oil system for                                                               |                                                                        |                                                                             |                                                               |                                                    |                 |
| 4                                                                                                            | Supplier                                                                     |                                                                        |                                                                             |                                                               | Manufacturer                                       |                 |
| 5                                                                                                            | Purchase order No.                                                           | Date                                                                   |                                                                             |                                                               | Inquiry No.                                        | Requisition No. |
| 6                                                                                                            |                                                                              |                                                                        |                                                                             |                                                               |                                                    |                 |
| 7                                                                                                            | <b>Filters:</b>                                                              |                                                                        |                                                                             |                                                               |                                                    |                 |
| 8                                                                                                            | <input type="radio"/> Purchaser item No.                                     | <input type="radio"/> Cartridges: make, model                          |                                                                             |                                                               |                                                    |                 |
| 9                                                                                                            | <input checked="" type="radio"/> Duplex <input type="radio"/> Single         | <input checked="" type="radio"/> Thermal relief valves                 |                                                                             |                                                               |                                                    |                 |
| 10                                                                                                           | <input checked="" type="radio"/> 10 µm filtration level                      | <input type="radio"/> Non-hygroscopic elements                         |                                                                             |                                                               |                                                    |                 |
| 11                                                                                                           | Manufacturer                                                                 | Furnish      extra sets of cartridges                                  |                                                                             |                                                               |                                                    |                 |
| 12                                                                                                           | Model                                                                        | <input type="radio"/> Per filter (extra over other spares)             |                                                                             |                                                               |                                                    |                 |
| 13                                                                                                           | Design / test pressure (kPa)                                                 | <input checked="" type="radio"/> Code construction/stamp               |                                                                             |                                                               |                                                    |                 |
| 14                                                                                                           | <input type="radio"/> Code construction/stamp                                | <input checked="" type="radio"/> Vent piped to reservoir               |                                                                             |                                                               |                                                    |                 |
| 15                                                                                                           | Material: case and top                                                       | <input checked="" type="radio"/> With flow indicators                  |                                                                             |                                                               |                                                    |                 |
| 16                                                                                                           | <input checked="" type="radio"/> Filter drains manifolded with cooler drains | 316 SS                                                                 |                                                                             |                                                               |                                                    |                 |
| 17                                                                                                           | <b>Lube oil rundown tanks</b>                                                |                                                                        |                                                                             |                                                               |                                                    |                 |
| 18                                                                                                           | <input checked="" type="radio"/> Required,                                   | <input type="checkbox"/> Capacity (litres)                             |                                                                             |                                                               |                                                    |                 |
| 19                                                                                                           |                                                                              | Material                                                               |                                                                             |                                                               |                                                    |                 |
| 20                                                                                                           | <input type="radio"/> Purchaser item No.                                     | Design / test pressure (kPa)                                           |                                                                             |                                                               |                                                    |                 |
| 21                                                                                                           | Time at flow rate (min)                                                      |                                                                        |                                                                             |                                                               |                                                    |                 |
| 22                                                                                                           | <input checked="" type="radio"/> Code construction/stamp                     |                                                                        |                                                                             |                                                               |                                                    |                 |
| 23                                                                                                           | <b>Coolers:</b>                                                              | <input type="checkbox"/> None required                                 | <input type="checkbox"/> Single                                             | <input type="checkbox"/> Connections only for off-base cooler |                                                    |                 |
| 24                                                                                                           | <b>Type:</b>                                                                 | <input type="radio"/> Shell-and-tube                                   | <input type="radio"/> Air-cooled                                            | <input checked="" type="radio"/> Plate frame                  | <input type="radio"/> Flanged vent & drain nozzles |                 |
| 25                                                                                                           |                                                                              | <input type="radio"/> Refer to specification                           | <input type="radio"/> Supplier std.                                         | <input checked="" type="radio"/> Special sizing criteria      | <input type="radio"/> Vent piped to reservoir      |                 |
| 26                                                                                                           |                                                                              | <input type="radio"/> Suitable for use with 150°C (300°F) coolant      | <input type="radio"/> Cooler drains manifolded with filter clean oil drains |                                                               |                                                    |                 |
| 27                                                                                                           | <input type="radio"/> Purchaser item Nos.                                    | <input type="checkbox"/> Duty: (kW)                                    |                                                                             |                                                               |                                                    |                 |
| 28                                                                                                           | <input type="radio"/> Tw in units                                            | <input type="checkbox"/> Manufacturer                                  |                                                                             |                                                               |                                                    |                 |
| 29                                                                                                           | <input type="radio"/> Details on data sheet                                  | <input type="checkbox"/> Model                                         |                                                                             |                                                               |                                                    |                 |
| 30                                                                                                           | <b>Shell and tube:</b>                                                       |                                                                        |                                                                             |                                                               |                                                    |                 |
| 31                                                                                                           | <input type="radio"/> Water side for steam heating                           | <input type="checkbox"/> Design/test shell side (kPa)                  |                                                                             |                                                               |                                                    |                 |
| 32                                                                                                           | <input type="checkbox"/> Water side corrosion allowance                      | <input type="checkbox"/> Design/test tube side (kPa)                   |                                                                             |                                                               |                                                    |                 |
| 33                                                                                                           | <input type="radio"/> TEMA class                                             | <input type="radio"/> Code construction/stamp                          |                                                                             |                                                               |                                                    |                 |
| 34                                                                                                           | <input type="checkbox"/> Fouling factor water/oil side                       | <input type="radio"/> Tube water velocity and flow rate (m/s; m³/h)    |                                                                             |                                                               |                                                    |                 |
| 35                                                                                                           | <input type="checkbox"/> Tube: L/OD/BWG                                      | <input type="checkbox"/> Material: shell                               |                                                                             |                                                               |                                                    |                 |
| 36                                                                                                           | <input type="radio"/> Oil temperature control valve with bypass line         | <input type="checkbox"/> Channels and covers                           |                                                                             |                                                               |                                                    |                 |
| 37                                                                                                           | <input type="radio"/> Thermal relief valves                                  | <input type="checkbox"/> Tube sheets and tubes                         |                                                                             |                                                               |                                                    |                 |
| 38                                                                                                           | <input type="radio"/> Flanged pneumatically operated                         | <input type="radio"/> Oil side operating pressure less than water side |                                                                             |                                                               |                                                    |                 |
| 39                                                                                                           | <input type="radio"/> Manual override                                        | <input type="checkbox"/> Removable tube and bundle                     |                                                                             |                                                               |                                                    |                 |
| 40                                                                                                           | <b>Air Cooled Heat Exchangers:</b>                                           |                                                                        |                                                                             |                                                               |                                                    |                 |
| 41                                                                                                           | <input checked="" type="radio"/> Dual fans                                   | <input checked="" type="radio"/> Stainless steel plate header boxes    |                                                                             |                                                               |                                                    |                 |
| 42                                                                                                           | <input checked="" type="radio"/> Austenitic stainless steel tubes            | <input checked="" type="radio"/> High vibration alarm for each fan     |                                                                             |                                                               |                                                    |                 |
| 43                                                                                                           | <b>Continuous flow transfer valves</b>                                       |                                                                        |                                                                             |                                                               |                                                    |                 |
| 44                                                                                                           | <input checked="" type="radio"/> Separate for coolers and filters            | <input type="checkbox"/> Rating:      kPa                              |                                                                             |                                                               |                                                    |                 |
| 45                                                                                                           | <input type="radio"/> Type                                                   | <input type="checkbox"/> Materials: body                               |                                                                             |                                                               |                                                    |                 |
| 46                                                                                                           | Manufacturer                                                                 | <input type="checkbox"/> Plug or ball                                  |                                                                             |                                                               |                                                    |                 |
| 47                                                                                                           | Model                                                                        | <input type="checkbox"/> Trim                                          |                                                                             |                                                               |                                                    |                 |
| 48                                                                                                           |                                                                              | <input type="checkbox"/> Spectacle blinds                              |                                                                             |                                                               |                                                    |                 |
| 49                                                                                                           |                                                                              |                                                                        |                                                                             |                                                               |                                                    |                 |
| 50                                                                                                           |                                                                              |                                                                        |                                                                             |                                                               |                                                    |                 |
| COMPANY REFERENCES                                                                                           |                                                                              |                                                                        |                                                                             | SUPPLIER REFERENCES                                           |                                                    |                 |
| Company :                                                                                                    |                                                                              |                                                                        |                                                                             | JOB N° :                                                      |                                                    |                 |

Column blank for revision number (X)



## General Specification

**GS EP MEC 281**

Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries  
according to ISO 10438 / API Standard 614

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|                                                                                                                     |                                                                                                                     | DATA SHEET         |    |                                                   |    |                                     |                                     |
|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------|----|---------------------------------------------------|----|-------------------------------------|-------------------------------------|
|                                                                                                                     |                                                                                                                     | Main Project Title |    |                                                   |    |                                     |                                     |
|                                                                                                                     |                                                                                                                     |                    |    |                                                   |    | Page                                | 4 of 4                              |
| Issuing Dpt                                                                                                         | Rev. / Date                                                                                                         | 1/                 | 2/ | 3/                                                | 4/ | 5/                                  |                                     |
|                                                                                                                     |                                                                                                                     | Written by :       |    |                                                   |    |                                     |                                     |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO <b>ISO 10438-3 / API STD 614</b> |                                                                                                                     |                    |    |                                                   |    | DS EP MEC 281                       |                                     |
| Annex B- General-purpose oil system data sheets                                                                     |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| Table B1 - Data sheet general-purpose oil system - SI units (continued)                                             |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| Job No.: [redacted] Item No.: [redacted]                                                                            |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 1                                                                                                                   | Applicable to <input type="checkbox"/> Proposal <input type="checkbox"/> Purchase <input type="checkbox"/> As built |                    |    | Site [redacted]                                   |    |                                     |                                     |
| 2                                                                                                                   | For [redacted]                                                                                                      |                    |    |                                                   |    |                                     |                                     |
| 3                                                                                                                   | Oil system for [redacted]                                                                                           |                    |    |                                                   |    |                                     |                                     |
| 4                                                                                                                   | Supplier [redacted]                                                                                                 |                    |    | Manufacturer [redacted]                           |    |                                     |                                     |
| 5                                                                                                                   | Purchase order No. [redacted] Date [redacted]                                                                       |                    |    | Inquiry No. [redacted] Requisition No. [redacted] |    |                                     |                                     |
| 6                                                                                                                   |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 7                                                                                                                   | Alarms and shutdowns                                                                                                |                    |    | Alarm                                             |    | Shutdown                            |                                     |
| 8                                                                                                                   | Condition                                                                                                           |                    |    |                                                   |    |                                     |                                     |
| 9                                                                                                                   | Low oil pressure                                                                                                    |                    |    |                                                   |    |                                     |                                     |
| 10                                                                                                                  | Low level for each oil reservoir                                                                                    |                    |    |                                                   |    |                                     |                                     |
| 11                                                                                                                  | Low level for each lube-oil rundown tank                                                                            |                    |    |                                                   |    |                                     |                                     |
| 12                                                                                                                  | Pump running for each stand-by pump                                                                                 |                    |    |                                                   |    |                                     |                                     |
| 13                                                                                                                  | High differential pressure for each oil filter set                                                                  |                    |    |                                                   |    |                                     |                                     |
| 14                                                                                                                  | <input type="checkbox"/> Requirements of ISO 10438-1/API 614                                                        |                    |    |                                                   |    |                                     |                                     |
| 15                                                                                                                  | Shop inspection                                                                                                     |                    |    | Shop test                                         |    | Required                            | Witness                             |
| 16                                                                                                                  | ● Compliance with inspector's checklist                                                                             |                    |    | ● Cleanliness                                     |    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 17                                                                                                                  | ● Required for system assemblies                                                                                    |                    |    | ● Unit console test                               |    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 18                                                                                                                  | ● Cleanliness prior to closure                                                                                      |                    |    | ● Check controls                                  |    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 19                                                                                                                  | ● Required for major components                                                                                     |                    |    | ● Changeover filters/coders                       |    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 20                                                                                                                  | ● Material certifications to be furnished                                                                           |                    |    | ● One and two pump operation                      |    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 21                                                                                                                  | ● Special examinations                                                                                              |                    |    | ● Sound level                                     |    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 22                                                                                                                  | ● Code construction/stamp                                                                                           |                    |    | ● Hydrotest assembled system                      |    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 23                                                                                                                  | ● Certified copies of all test logs and data                                                                        |                    |    | ● Use for complete unit system test               |    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 24                                                                                                                  | ● Check pipe strain                                                                                                 |                    |    | ● Certified copies of all test logs and data      |    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 25                                                                                                                  | ● Pipe radiography                                                                                                  |                    |    | ● Sound level recorded during test                |    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 26                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 27                                                                                                                  | Vendor's Data:                                                                                                      |                    |    |                                                   |    |                                     |                                     |
| 28                                                                                                                  | ● Coordination meeting to be held within 4-6 weeks after order commitment                                           |                    |    | Mandatory                                         |    |                                     |                                     |
| 29                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 30                                                                                                                  | Comments:                                                                                                           |                    |    |                                                   |    |                                     |                                     |
| 31                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 32                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 33                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 34                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 35                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 36                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 37                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 38                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 39                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 40                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 41                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 42                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 43                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 44                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 45                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 46                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 47                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 48                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 49                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| 50                                                                                                                  |                                                                                                                     |                    |    |                                                   |    |                                     |                                     |
| COMPANY REFERENCES                                                                                                  |                                                                                                                     |                    |    | SUPPLIER REFERENCES                               |    |                                     |                                     |
|                                                                                                                     |                                                                                                                     |                    |    | Company :                                         |    |                                     |                                     |
|                                                                                                                     |                                                                                                                     |                    |    | JOB N° :                                          |    |                                     |                                     |

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| General Specification                                                                                            |                         | GS EP MEC 281    |
|------------------------------------------------------------------------------------------------------------------|-------------------------|------------------|
| Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries<br>according to ISO 10438 / API Standard 614 |                         |                  |
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## Datasheet **ISO 10438-4**

| TOTAL                                                                                                     |                                                                                                                                                                                                                      | DATA SHEET                                                          |              |                                   |                |                 |                           |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|--------------|-----------------------------------|----------------|-----------------|---------------------------|
|                                                                                                           |                                                                                                                                                                                                                      | Main Project Title                                                  |              |                                   |                | Page 1 of 4     |                           |
| Issuing Dpt                                                                                               | Rev. / Date                                                                                                                                                                                                          | 1/                                                                  | 2/           | 3/                                | 4/             | 5/              |                           |
| Written by :                                                                                              |                                                                                                                                                                                                                      |                                                                     |              |                                   |                |                 |                           |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS AND AUXILIARIES ACCORDING TO ISO 10438-4 / API STD 614 |                                                                                                                                                                                                                      |                                                                     |              |                                   | DS EP MEC 281  |                 |                           |
| Annex B - Data sheets                                                                                     |                                                                                                                                                                                                                      |                                                                     |              |                                   |                |                 |                           |
| Table B1 - Data sheet dry gas seal module - SI units                                                      |                                                                                                                                                                                                                      |                                                                     |              |                                   |                |                 |                           |
| Job No.:                                                                                                  |                                                                                                                                                                                                                      |                                                                     |              |                                   | Item No.:      |                 |                           |
| 1                                                                                                         | Applicable to                                                                                                                                                                                                        | <input type="checkbox"/> Proposal <input type="checkbox"/> Purchase |              | <input type="checkbox"/> As built |                |                 |                           |
| 2                                                                                                         | For                                                                                                                                                                                                                  |                                                                     |              |                                   | Site           |                 |                           |
| 3                                                                                                         | Oil system for                                                                                                                                                                                                       |                                                                     |              |                                   |                |                 |                           |
| 4                                                                                                         | Supplier                                                                                                                                                                                                             |                                                                     |              |                                   | Manufacturer   |                 |                           |
| 5                                                                                                         | Purchase order No.                                                                                                                                                                                                   | Date                                                                |              | Inquiry No.                       |                | Requisition No. |                           |
| 6                                                                                                         |                                                                                                                                                                                                                      |                                                                     |              |                                   |                |                 |                           |
| 7                                                                                                         | Explanations:                                                                                                                                                                                                        |                                                                     |              |                                   |                |                 |                           |
| 8                                                                                                         | - The party to complete the information is indicated as follow s:                                                                                                                                                    |                                                                     |              |                                   |                |                 |                           |
| 9                                                                                                         | <input type="radio"/> Purchaser <input type="checkbox"/> Vendor <input type="checkbox"/> Either, but by vendor if not by purchaser                                                                                   |                                                                     |              |                                   |                |                 |                           |
| 10                                                                                                        | - An asterisk * specifies a requirement, value or criterion.                                                                                                                                                         |                                                                     |              |                                   |                |                 |                           |
| 11                                                                                                        | - Designations in parentheses ( ) are: explained in the cited standard; numbers without a prefix are subclause numbers; those prefixed "T" are text figure numbers; those prefixed "A" are Annex "A" figure numbers. |                                                                     |              |                                   |                |                 |                           |
| 12                                                                                                        | <input type="radio"/> Drawing requirements <input type="radio"/> Component review                                                                                                                                    |                                                                     |              |                                   |                |                 |                           |
| 13                                                                                                        |                                                                                                                                                                                                                      |                                                                     |              |                                   |                |                 |                           |
| 14                                                                                                        | System responsibility:                                                                                                                                                                                               |                                                                     |              |                                   |                |                 |                           |
| 15                                                                                                        | <input checked="" type="radio"/> Vendor responsible for system design <input checked="" type="radio"/> Vendor responsible for installation <input checked="" type="radio"/> Vendor responsible for scope of supply   |                                                                     |              |                                   |                |                 |                           |
| 16                                                                                                        | Supply arrangement:                                                                                                                                                                                                  |                                                                     |              |                                   |                |                 |                           |
| 17                                                                                                        | <input checked="" type="radio"/> Separate modules for each casing <input type="radio"/> Combined module for train                                                                                                    |                                                                     |              |                                   |                |                 |                           |
| 18                                                                                                        | <input checked="" type="radio"/> Module mounted on compressor baseplate                                                                                                                                              |                                                                     |              |                                   |                |                 |                           |
| 19                                                                                                        | Basic system details (see referenced Figures in GS EP MEC 281)                                                                                                                                                       |                                                                     |              |                                   |                |                 |                           |
| 20                                                                                                        | Dry Gas Seal Specifics:                                                                                                                                                                                              |                                                                     |              |                                   |                |                 |                           |
| 21                                                                                                        | <input type="radio"/> Double (Figure B.1) <input checked="" type="radio"/> Tandem with intermediate labyrinths (Fig B.2) <input type="radio"/> Tandem (Figure B.3) <input type="radio"/> Single (Figure B.4)         |                                                                     |              |                                   |                |                 |                           |
| 22                                                                                                        | <input type="radio"/> Seal manufacturer <input type="radio"/> Seal model <input type="radio"/> Seal Serial number                                                                                                    |                                                                     |              |                                   |                |                 |                           |
| 23                                                                                                        |                                                                                                                                                                                                                      |                                                                     |              |                                   |                |                 |                           |
| 24                                                                                                        | Seal Gas Conditions                                                                                                                                                                                                  |                                                                     |              |                                   |                |                 |                           |
| 25                                                                                                        | Description of gas                                                                                                                                                                                                   |                                                                     | Primary Seal |                                   | Secondary Seal |                 | Tertiary Seal             |
| 26                                                                                                        | Supply pressure                                                                                                                                                                                                      |                                                                     | kpa          |                                   | kpa            |                 | Nitrogen / Air Instrument |
| 27                                                                                                        | Supply temperature                                                                                                                                                                                                   |                                                                     | °C           |                                   | °C             |                 |                           |
| 28                                                                                                        | Flow rate                                                                                                                                                                                                            |                                                                     | Nm3/h        |                                   | Nm3/h          |                 |                           |
| 29                                                                                                        | Description of gas                                                                                                                                                                                                   |                                                                     |              |                                   |                |                 |                           |
| 30                                                                                                        | Seal gas hazardous (yes/no)                                                                                                                                                                                          |                                                                     |              |                                   |                |                 |                           |
| 31                                                                                                        | Seal gas composition below or refer to                                                                                                                                                                               |                                                                     |              |                                   |                |                 |                           |
| 32                                                                                                        | Seal gas composition: Gas                                                                                                                                                                                            |                                                                     | Case 1 (%)   | Case 2 (%)                        | Case 3 (%)     | Startup (%)     | Tests (%)                 |
| 33                                                                                                        | Methane                                                                                                                                                                                                              | C1 CH <sub>4</sub>                                                  |              |                                   |                |                 |                           |
| 34                                                                                                        | Ethane                                                                                                                                                                                                               | C2 C <sub>2</sub> H <sub>6</sub>                                    |              |                                   |                |                 |                           |
| 35                                                                                                        | Propane                                                                                                                                                                                                              | C3 C <sub>3</sub> H <sub>8</sub>                                    |              |                                   |                |                 |                           |
| 36                                                                                                        | Iso-Butane                                                                                                                                                                                                           | iC4 C <sub>4</sub> H <sub>10</sub>                                  |              |                                   |                |                 |                           |
| 37                                                                                                        | n-Butane                                                                                                                                                                                                             | nC4 C <sub>4</sub> H <sub>10</sub>                                  |              |                                   |                |                 |                           |
| 38                                                                                                        | Iso-Pentane                                                                                                                                                                                                          | iC5 C <sub>5</sub> H <sub>12</sub>                                  |              |                                   |                |                 |                           |
| 39                                                                                                        | n-Pentane                                                                                                                                                                                                            | nC5 C <sub>5</sub> H <sub>12</sub>                                  |              |                                   |                |                 |                           |
| 40                                                                                                        | n-Hexane                                                                                                                                                                                                             | O6 C <sub>6</sub> H <sub>14</sub>                                   |              |                                   |                |                 |                           |
| 41                                                                                                        | n-Heptane                                                                                                                                                                                                            | C7 C <sub>7</sub> H <sub>16</sub>                                   |              |                                   |                |                 |                           |
| 42                                                                                                        | n-Octane                                                                                                                                                                                                             | C8 C <sub>8</sub> H <sub>18</sub>                                   |              |                                   |                |                 |                           |
| 43                                                                                                        | n-Nonane                                                                                                                                                                                                             | C9 C <sub>9</sub> H <sub>20</sub>                                   |              |                                   |                |                 |                           |
| 44                                                                                                        | n-Decane                                                                                                                                                                                                             | C10+ C <sub>10</sub> H <sub>22</sub>                                |              |                                   |                |                 |                           |
| 45                                                                                                        | Water                                                                                                                                                                                                                | H <sub>2</sub> O                                                    |              |                                   |                |                 |                           |
| 46                                                                                                        | Carbon dioxide                                                                                                                                                                                                       | CO <sub>2</sub>                                                     |              |                                   |                |                 |                           |
| 47                                                                                                        | Nitrogen                                                                                                                                                                                                             | N <sub>2</sub>                                                      |              |                                   |                |                 |                           |
| 48                                                                                                        | Hydrogen sulfide                                                                                                                                                                                                     | H <sub>2</sub> S                                                    |              |                                   |                |                 |                           |
| 49                                                                                                        | Helium                                                                                                                                                                                                               | He                                                                  |              |                                   |                |                 |                           |
| 50                                                                                                        | MW Molecular weight                                                                                                                                                                                                  |                                                                     |              |                                   |                |                 |                           |
| 51                                                                                                        | <input type="checkbox"/> Special provisions for back-up supply are necessary                                                                                                                                         |                                                                     |              |                                   |                |                 |                           |
| Column blank for revision number (X)                                                                      |                                                                                                                                                                                                                      |                                                                     |              |                                   |                |                 |                           |
| COMPANY REFERENCES                                                                                        |                                                                                                                                                                                                                      |                                                                     |              | SUPPLIER REFERENCES               |                |                 |                           |
|                                                                                                           |                                                                                                                                                                                                                      |                                                                     |              | Company :                         |                |                 |                           |
|                                                                                                           |                                                                                                                                                                                                                      |                                                                     |              | JOB N° :                          |                |                 |                           |

| TOTAL                                                                                                     |                                                                                  | DATA SHEET                             |                                     |                                                                           |               |                 |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------------------------------------|-------------------------------------|---------------------------------------------------------------------------|---------------|-----------------|
| Main Project Title                                                                                        |                                                                                  | Page 2 of 4                            |                                     |                                                                           |               |                 |
| Issuing Dpt                                                                                               | Rev. / Date                                                                      | 1/                                     | 2/                                  | 3/                                                                        | 4/            | 5/              |
| Written by :                                                                                              |                                                                                  |                                        |                                     |                                                                           |               |                 |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS AND AUXILIARIES ACCORDING TO ISO 10438-4 / API STD 614 |                                                                                  |                                        |                                     |                                                                           | DS EP MEC 281 |                 |
| Annex B - Data sheets                                                                                     |                                                                                  |                                        |                                     |                                                                           |               |                 |
| Table B1 - Data sheet dry gas seal module - SI units (continued)                                          |                                                                                  |                                        |                                     |                                                                           |               |                 |
| Job No.:                                                                                                  |                                                                                  | Item No.:                              |                                     |                                                                           |               |                 |
| 1                                                                                                         | Applicable to                                                                    | <input type="checkbox"/> Proposal      | <input type="checkbox"/> Purchase   | <input type="checkbox"/> As built                                         |               |                 |
| 2                                                                                                         | For                                                                              |                                        |                                     |                                                                           | Site          |                 |
| 3                                                                                                         | Oil system for                                                                   |                                        |                                     |                                                                           | Manufacturer  |                 |
| 4                                                                                                         | Supplier                                                                         |                                        |                                     |                                                                           | Inquiry No.   | Requisition No. |
| 5                                                                                                         | Purchase order No.                                                               | Date                                   |                                     |                                                                           |               |                 |
| 6                                                                                                         |                                                                                  |                                        |                                     |                                                                           |               |                 |
| 7                                                                                                         | Options                                                                          |                                        |                                     |                                                                           |               |                 |
| 8                                                                                                         | Basic                                                                            |                                        |                                     |                                                                           |               |                 |
| 9                                                                                                         | ● Seal gas filter module (Figures B.5)                                           |                                        |                                     | ● Flow monitoring: differential pressure (Figure B.15)                    |               |                 |
| 10                                                                                                        | ● Separation gas filter module (Figure B.18) <input type="checkbox"/>            |                                        |                                     | ○ Flow monitoring: back pressure (Figure B.16)                            |               |                 |
| 11                                                                                                        | ● Differential pressure control (Figure B.8) <input type="checkbox"/>            |                                        |                                     | ● Flow measuring (Figure B.17)                                            |               |                 |
| 12                                                                                                        | ● Flow control (Figures B.9, B.10 and B.11)                                      |                                        |                                     | Separation gas modules                                                    |               |                 |
| 13                                                                                                        | For option of Figure B.2 (tandem with intermediate labyrinth)                    |                                        |                                     | ● Options (Figures B.19 and B.20)                                         |               |                 |
| 14                                                                                                        | ○ Differential pressure control (Figure B.12) ● Pressure control                 |                                        |                                     |                                                                           |               |                 |
| 15                                                                                                        | ● Flow control (Figures B.13 and B.14)                                           |                                        |                                     |                                                                           |               |                 |
| 16                                                                                                        | Miscellaneous                                                                    |                                        |                                     |                                                                           |               |                 |
| 17                                                                                                        | ● Cartridge materials : All Stainless Steel with Methanol resitant seals         |                                        |                                     | ● Flow transmitters (Refer to GS EP MEC 281 Part 4 Clause 6.3.1 )         |               |                 |
| 18                                                                                                        | ● Double blocks and bleeds required                                              |                                        |                                     | ● Special requirements (Refer to GE EP MEC 281 )                          |               |                 |
| 19                                                                                                        | ● Instrument test valves required                                                |                                        |                                     | ● Seal gas flow measurement (Refer to GS EP MEC 281 Part 4 Clause 6.3.1 ) |               |                 |
| 20                                                                                                        | Components                                                                       |                                        |                                     |                                                                           |               |                 |
| 21                                                                                                        | Piping and tubing (Refer to GS EP MEC 281 Part 1 clause 5.1)                     |                                        |                                     |                                                                           |               |                 |
| 22                                                                                                        | ● Tight shutoff required ○ Carbon steel slip-on flanges ○ Through studs required |                                        |                                     |                                                                           |               |                 |
| 23                                                                                                        | ○ Tubing fittings                                                                |                                        | Manufacturer                        | model                                                                     |               |                 |
| 24                                                                                                        | ● Heat tracing required by                                                       |                                        | <input type="checkbox"/> Purchaser  | <input checked="" type="checkbox"/> Vendor                                |               |                 |
| 25                                                                                                        | Continuous flow transfer valves:                                                 |                                        |                                     |                                                                           |               |                 |
| 26                                                                                                        | Service application                                                              | Seal Gas                               | Buffer Gas                          | Separation Gas                                                            |               |                 |
| 27                                                                                                        | ○ Common for coolers and filters                                                 | <input type="checkbox"/>               | <input type="checkbox"/>            | <input type="checkbox"/>                                                  |               |                 |
| 28                                                                                                        | ● Tight shutoff required                                                         | <input checked="" type="checkbox"/>    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>                                       |               |                 |
| 29                                                                                                        | ○ Type                                                                           |                                        |                                     |                                                                           |               |                 |
| 30                                                                                                        | ○ Manufacturer                                                                   |                                        |                                     |                                                                           |               |                 |
| 31                                                                                                        | ○ Model                                                                          |                                        |                                     |                                                                           |               |                 |
| 32                                                                                                        | ○ Pressure rating (kPa)                                                          |                                        |                                     |                                                                           |               |                 |
| 33                                                                                                        | ○ Strainer required                                                              | <input checked="" type="checkbox"/>    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>                                       |               |                 |
| 34                                                                                                        | ○ Lifting jack required                                                          | <input type="checkbox"/>               | <input type="checkbox"/>            | <input type="checkbox"/>                                                  |               |                 |
| 35                                                                                                        | ● Body materials                                                                 | 316 SS                                 | 316 SS                              | 316 SS                                                                    |               |                 |
| 36                                                                                                        | ● Plug or ball material                                                          | 316 SS                                 | 316 SS                              | 316 SS                                                                    |               |                 |
| 37                                                                                                        | ● Trim material                                                                  | 316 SS                                 | 316 SS                              | 316 SS                                                                    |               |                 |
| 38                                                                                                        | Filters:                                                                         |                                        |                                     |                                                                           |               |                 |
| 39                                                                                                        | Service application                                                              | Seal Gas                               | Buffer Gas                          | Separation Gas                                                            |               |                 |
| 40                                                                                                        | ○ Purchaser item No.                                                             |                                        |                                     |                                                                           |               |                 |
| 41                                                                                                        | ● Twin                                                                           | <input checked="" type="checkbox"/>    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>                                       |               |                 |
| 42                                                                                                        | ○ Option Nos.                                                                    |                                        |                                     |                                                                           |               |                 |
| 43                                                                                                        | ● Filtration level                                                               | 1 micron abs                           | 2 micron abs                        | 3 microns abs                                                             |               |                 |
| 44                                                                                                        | ○ Manufacturer                                                                   |                                        |                                     |                                                                           |               |                 |
| 45                                                                                                        | ○ Model                                                                          |                                        |                                     |                                                                           |               |                 |
| 46                                                                                                        | ○ Design/test gauge pressure (kPa)                                               |                                        |                                     |                                                                           |               |                 |
| 47                                                                                                        | ● Code construction/stamp                                                        | <input checked="" type="checkbox"/>    | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>                                       |               |                 |
| 48                                                                                                        | ● Material: case and top                                                         | 316 SS                                 | 316 SS                              | 316 SS                                                                    |               |                 |
| 49                                                                                                        | ● Cartridges: material                                                           | 316 SS                                 | 316 SS                              | 316 SS                                                                    |               |                 |
| 50                                                                                                        | ● Filter body diameter (mm)                                                      | 316 SS                                 | 316 SS                              | 316 SS                                                                    |               |                 |
| 51                                                                                                        | Furnish extra sets of cartridges                                                 | ○ per filtre (extra over other spares) |                                     |                                                                           |               |                 |
| 52                                                                                                        | Components Testing:                                                              |                                        |                                     |                                                                           |               |                 |
| 53                                                                                                        | ● Functional test ● Pressure test                                                |                                        |                                     |                                                                           |               |                 |
| COMPANY REFERENCES                                                                                        |                                                                                  |                                        |                                     | SUPPLIER REFERENCES                                                       |               |                 |
|                                                                                                           |                                                                                  |                                        |                                     | Company :                                                                 |               |                 |
|                                                                                                           |                                                                                  |                                        |                                     | JOB N° :                                                                  |               |                 |

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# General Specification

GS EP MEC 281

Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries  
according to ISO 10438 / API Standard 614

Rev.: 10

Effective date: 10/2012

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|                                                                                                              |                                                  | DATA SHEET                        |                                              |                                   |                                     |                                     |
|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-----------------------------------|----------------------------------------------|-----------------------------------|-------------------------------------|-------------------------------------|
|                                                                                                              |                                                  | Main Project Title                |                                              |                                   | Page 3 of 4                         |                                     |
| Issuing Dpt                                                                                                  | Rev. / Date                                      | 1/                                | 2/                                           | 3/                                | 4/                                  | 5/                                  |
| Written by :                                                                                                 |                                                  |                                   |                                              |                                   |                                     |                                     |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO ISO 10438-4 / API STD 614 |                                                  |                                   |                                              |                                   | DS EP MEC 281                       |                                     |
| Annex B - Data sheets                                                                                        |                                                  |                                   |                                              |                                   |                                     |                                     |
| Table B1 - Data sheet dry gas seal module - SI units (continued)                                             |                                                  |                                   |                                              |                                   |                                     |                                     |
| Job No.:                                                                                                     |                                                  | Item No.:                         |                                              |                                   |                                     |                                     |
| 1                                                                                                            | Applicable to                                    | <input type="checkbox"/> Proposal | <input type="checkbox"/> Purchase            | <input type="checkbox"/> As built | Site                                |                                     |
| 2                                                                                                            | For                                              |                                   |                                              |                                   |                                     |                                     |
| 3                                                                                                            | Oil system for                                   |                                   |                                              |                                   | Manufacturer                        |                                     |
| 4                                                                                                            | Supplier                                         |                                   |                                              |                                   | Inquiry No.                         |                                     |
| 5                                                                                                            | Purchase order No.                               | Date                              |                                              |                                   | Requisition No.                     |                                     |
| 6                                                                                                            |                                                  |                                   |                                              |                                   |                                     |                                     |
| 7                                                                                                            | Alarms and shutdowns                             |                                   |                                              |                                   |                                     |                                     |
| 8                                                                                                            | Condition                                        |                                   | Alarm                                        |                                   | Shutdown                            |                                     |
| 9                                                                                                            | Low seal gas differential pressure               |                                   | <input checked="" type="checkbox"/>          |                                   | <input checked="" type="checkbox"/> |                                     |
| 10                                                                                                           | Low seal gas flow                                |                                   | <input checked="" type="checkbox"/>          |                                   | <input checked="" type="checkbox"/> |                                     |
| 11                                                                                                           | Low seal gas supply pressure                     |                                   | <input checked="" type="checkbox"/>          |                                   | <input checked="" type="checkbox"/> |                                     |
| 12                                                                                                           | Low seal gas temperature                         |                                   | <input checked="" type="checkbox"/>          |                                   | <input checked="" type="checkbox"/> |                                     |
| 13                                                                                                           | Low barrier gas differential pressure            |                                   | <input type="checkbox"/>                     |                                   | <input type="checkbox"/>            |                                     |
| 14                                                                                                           | Low barrier gas flow                             |                                   | <input type="checkbox"/>                     |                                   | <input type="checkbox"/>            |                                     |
| 15                                                                                                           | Low buffer gas differential pressure             |                                   | <input checked="" type="checkbox"/>          |                                   | <input checked="" type="checkbox"/> |                                     |
| 16                                                                                                           | Low buffer gas filter differential pressure      |                                   | <input checked="" type="checkbox"/>          |                                   | <input type="checkbox"/>            |                                     |
| 17                                                                                                           | Low buffer gas flow                              |                                   | <input checked="" type="checkbox"/>          |                                   | <input checked="" type="checkbox"/> |                                     |
| 18                                                                                                           | Low buffer gas pressure                          |                                   | <input checked="" type="checkbox"/>          |                                   | <input checked="" type="checkbox"/> |                                     |
| 19                                                                                                           | Low separation gas filter differential pressure  |                                   | <input checked="" type="checkbox"/>          |                                   | <input type="checkbox"/>            |                                     |
| 20                                                                                                           | Low separation gas flow                          |                                   | <input checked="" type="checkbox"/>          |                                   | <input checked="" type="checkbox"/> |                                     |
| 21                                                                                                           | Low separation gas pressure                      |                                   | <input checked="" type="checkbox"/>          |                                   | <input checked="" type="checkbox"/> |                                     |
| 22                                                                                                           | High primary vent pressure                       |                                   | <input checked="" type="checkbox"/>          |                                   | <input checked="" type="checkbox"/> |                                     |
| 23                                                                                                           | High primary vent flow                           |                                   | <input checked="" type="checkbox"/>          |                                   | <input checked="" type="checkbox"/> |                                     |
| 24                                                                                                           | Low primary vent flow                            |                                   | <input checked="" type="checkbox"/>          |                                   | <input checked="" type="checkbox"/> |                                     |
| 25                                                                                                           | Low primary differential pressure                |                                   | <input checked="" type="checkbox"/>          |                                   | <input checked="" type="checkbox"/> |                                     |
| 26                                                                                                           | High seal gas filter differential pressure       |                                   | <input checked="" type="checkbox"/>          |                                   | <input type="checkbox"/>            |                                     |
| 27                                                                                                           | High buffer gas filter differential pressure     |                                   | <input checked="" type="checkbox"/>          |                                   | <input type="checkbox"/>            |                                     |
| 28                                                                                                           | High separation gas filter differential pressure |                                   | <input checked="" type="checkbox"/>          |                                   | <input type="checkbox"/>            |                                     |
| 29                                                                                                           |                                                  |                                   |                                              |                                   |                                     |                                     |
| 30                                                                                                           |                                                  |                                   |                                              |                                   |                                     |                                     |
| 31                                                                                                           |                                                  |                                   |                                              |                                   |                                     |                                     |
| 32                                                                                                           |                                                  |                                   |                                              |                                   |                                     |                                     |
| 33                                                                                                           |                                                  |                                   |                                              |                                   |                                     |                                     |
| 34                                                                                                           | Shop inspection                                  |                                   | Shop test                                    |                                   | Required                            | Witness                             |
| 35                                                                                                           | ● Compliance with inspector's checklist          |                                   | ● Cleanliness                                |                                   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 36                                                                                                           | ● Required for system assemblies                 |                                   | ● Hydrotest assembled system                 |                                   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 37                                                                                                           | ● Cleanliness prior to closure                   |                                   | ● Functional test                            |                                   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 38                                                                                                           | ● Required for major components                  |                                   | ● Endurance tests 4 hours run                |                                   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 39                                                                                                           | ● Material certifications to be furnished        |                                   | ● Check controls                             |                                   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 40                                                                                                           | ● Special examinations                           |                                   | ● Changeover filters                         |                                   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 41                                                                                                           | ● Code construction/stamp                        |                                   | ● Pneumatic test of assembly                 |                                   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 42                                                                                                           | ● Certified copies of all test logs and data     |                                   | ● Pressure test of spools                    |                                   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 43                                                                                                           | ○                                                |                                   | ● Sound level                                |                                   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 44                                                                                                           | ○                                                |                                   | ● Use units mechanical test                  |                                   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 45                                                                                                           | ○                                                |                                   | ● Use for complete unit system test          |                                   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 46                                                                                                           |                                                  |                                   | ● Certified copies of all test logs and data |                                   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 47                                                                                                           | Remarks                                          |                                   |                                              |                                   |                                     |                                     |
| 48                                                                                                           |                                                  |                                   |                                              |                                   |                                     |                                     |
| 49                                                                                                           |                                                  |                                   |                                              |                                   |                                     |                                     |
| 50                                                                                                           |                                                  |                                   |                                              |                                   |                                     |                                     |
| 51                                                                                                           |                                                  |                                   |                                              |                                   |                                     |                                     |
| COMPANY REFERENCES                                                                                           |                                                  |                                   | SUPPLIER REFERENCES                          |                                   |                                     |                                     |
|                                                                                                              |                                                  |                                   | Company :                                    |                                   |                                     |                                     |
|                                                                                                              |                                                  |                                   | JOB N° :                                     |                                   |                                     |                                     |

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Lubrication, Shaft Sealing, and Oil Control Systems and Auxiliaries  
according to ISO 10438 / API Standard 614

Rev.: 10

Effective date: 10/2012

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|                                    |                                                                                                                                          | DATA SHEET                                                          |    |                                              |                                |                                   |  |
|---------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|----|----------------------------------------------|--------------------------------|-----------------------------------|--|
|                                                                                                                     |                                                                                                                                          | Main Project Title                                                  |    |                                              |                                | Page 4 of 4                       |  |
| Issuing Dpt                                                                                                         | Rev. / Date                                                                                                                              | 1/                                                                  | 2/ | 3/                                           | 4/                             | 5/                                |  |
| Written by :                                                                                                        |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| LUBRICATION, SHAFT SEALING AND OIL CONTROL SYSTEMS<br>AND AUXILIARIES ACCORDING TO <b>ISO 10438-2 / API STD 614</b> |                                                                                                                                          |                                                                     |    |                                              |                                | DS EP MEC 281                     |  |
| Annex B- Data sheets                                                                                                |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| Table B2 - Data sheet dry gas seal - SI units                                                                       |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| Job No.:                                                                                                            |                                                                                                                                          |                                                                     |    |                                              | Item No.:                      |                                   |  |
| 1                                                                                                                   | Applicable to                                                                                                                            | <input type="checkbox"/> Proposal <input type="checkbox"/> Purchase |    | Site                                         |                                | <input type="checkbox"/> As built |  |
| 2                                                                                                                   | For                                                                                                                                      |                                                                     |    |                                              |                                |                                   |  |
| 3                                                                                                                   | Oil system for                                                                                                                           |                                                                     |    |                                              |                                |                                   |  |
| 4                                                                                                                   | Supplier                                                                                                                                 |                                                                     |    |                                              | Manufacturer                   |                                   |  |
| 5                                                                                                                   | Purchase order No.                                                                                                                       | Date                                                                |    | Inquiry No.                                  |                                | Requisition No.                   |  |
| 6                                                                                                                   |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 7                                                                                                                   | <b>Dry gas seal design</b>                                                                                                               |                                                                     |    |                                              |                                |                                   |  |
| 8                                                                                                                   | Rotational speed                                                                                                                         | rpm                                                                 |    |                                              | Maximum Continuous speed (MCS) | rpm                               |  |
| 9                                                                                                                   | <input type="radio"/> Application <input type="checkbox"/> New <input type="checkbox"/> Retrofit                                         |                                                                     |    |                                              | Vendor drawing No.             |                                   |  |
| 10                                                                                                                  | <input type="checkbox"/> Rotational view ed from driver end <input type="checkbox"/> clockwise <input type="checkbox"/> counterclockwise |                                                                     |    |                                              |                                |                                   |  |
| 11                                                                                                                  | <input type="radio"/> Vent gauge pressure normal/max:                                                                                    |                                                                     |    |                                              |                                |                                   |  |
| 12                                                                                                                  | <input type="radio"/> Equipment suction gauge pressure (min/max):                                                                        |                                                                     |    |                                              |                                |                                   |  |
| 13                                                                                                                  | <input type="radio"/> Maximum sealing gauge pressure:                                                                                    |                                                                     |    |                                              | kPa                            |                                   |  |
| 14                                                                                                                  | <input type="radio"/> Settle out gauge pressure                                                                                          |                                                                     |    |                                              | kPa                            |                                   |  |
| 15                                                                                                                  | <input type="radio"/> Equipment discharge temperature                                                                                    |                                                                     |    |                                              | kPa                            |                                   |  |
| 16                                                                                                                  | <input type="radio"/> Process relief valve setting                                                                                       |                                                                     |    |                                              | kPa                            |                                   |  |
| 17                                                                                                                  | <input type="radio"/> Seal maximum all working gauge pressure                                                                            |                                                                     |    |                                              | kPa                            |                                   |  |
| 18                                                                                                                  | <b>Leakage rates:</b>                                                                                                                    |                                                                     |    |                                              |                                |                                   |  |
| 19                                                                                                                  |                                                                                                                                          |                                                                     |    | Normal operation                             |                                | Static                            |  |
| 20                                                                                                                  | Primary vent                                                                                                                             |                                                                     |    |                                              |                                |                                   |  |
| 21                                                                                                                  | Secondary vent                                                                                                                           |                                                                     |    |                                              |                                |                                   |  |
| 22                                                                                                                  | Secondary vent for intermediate labyrinth                                                                                                |                                                                     |    |                                              |                                |                                   |  |
| 23                                                                                                                  | <b>Comments:</b>                                                                                                                         |                                                                     |    |                                              |                                |                                   |  |
| 24                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 25                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 26                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 27                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 28                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 29                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 30                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 31                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 32                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 33                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 34                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 35                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 36                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 37                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 38                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 39                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 40                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 41                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 42                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 43                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 44                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 45                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 46                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 47                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 48                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 49                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| 50                                                                                                                  |                                                                                                                                          |                                                                     |    |                                              |                                |                                   |  |
| COMPANY REFERENCES                                                                                                  |                                                                                                                                          |                                                                     |    | SUPPLIER REFERENCES<br>Company :<br>JOB N° : |                                |                                   |  |

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