



Exploration & Production

GENERAL SPECIFICATION

INSTRUMENTATION

GS INS 107

Design and installation of instrumentation links

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1. Scope

This Specification defines the principles underlying the design and construction of instrument lines.

This specification applies to all onshore and offshore installations.

Submarine links and telecommunication links are not included in this specification.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
IEC 60364	Electrical installations of buildings
IEC 60079	Electrical apparatus for potentially explosive atmospheres
IEC 60529	Degrees of protection provided by enclosures (IP code)
IEC 60332	Resistance of electrical cables to fire
IEC 60446	Identification of cables
IEC 60079-07	Electrical apparatus for explosive gas atmospheres – Part 7: Increased safety 'e'.
API RP 552	Transmission systems

Professional Documents

Reference	Title
AISI	Data sheet 904L
AISI	Data sheet 316L
NAS 1638	Cleanliness Requirements of Parts used in Hydraulic Systems

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS ELE 031	Design of earthing and bonding systems
GS ELE 161	Electrical cables
GS INS 101	Instrumentation engineering, supply and construction general requirements
GS INS 104	Design of the generation and distribution of instrument air or gas
GS INS 134	Design and supply of information, control and safety system
GS INS 146	Design of generation and distribution of hydraulic energy
GS PVV 112	Piping materials classes
GS SAF 261	Pressure protection and relief, emergency shutdown and depressurisation
GS SAF 312	Guidelines for selecting and installing fire and gas detection systems

3. Details and deviations from reference documents

3.1 Electrical links

The electrical equipment and installation to be installed in potentially explosive areas shall comply with IEC 60079.

3.1.1 Cables

3.1.1.1 Specifications

Cable used in zone 1 or 2 of explosive areas shall be armoured. For low level signals, the cables shall also be shielded. Outside of the explosive area, the use of cable armouring will depend on the environment.

20 % spare capacity shall be provided in multicore cables.

All conductors shall be connected to a terminal at both ends. Spare conductors shall be grounded at both points in compliance with EMC recommendations.

Long links (> 1000 m) may be set up using composite cables and shall be lightning protected.

Cables for digital links - coaxials, twisted pairs or optical fibres - shall be specified by the supplier of the equipment to be connected.

3.1.1.2 Conductor colour-coding

Alternating current:

Blue and **green/yellow** are reserved: **blue** for neutral links and **green/yellow** for equipotential earthing links (IEC 60446).

Each phase conductor shall be colour-coded differently.

Direct current:

Green/yellow is reserved for equipotential earthing links (IEC 60446).

3.1.2 Junction boxes

It will preferably be of type Ex e (IEC 60079-07) and IP 55 (IEC 60529) at the minimum.

The material used will preferably be reinforced polyester with stainless steel screw fastenings.

There shall not be more than one multicable per junction box.

Cable entries shall be through the bottom via glands; glands shall be specified according to area requirements.

3.1.3 Marshalling cabinets

Marshalling cabinets shall be used for cross-connection of I/O's between field image terminal blocks and digital system acquisition boards.

Marshalling cabinets cable entries shall be through the bottom, via the raised floor of the technical room.

For each cable, the first terminal strip in the technical room shall be the image of the terminal strip in the junction box.

The terminal strips shall be arranged vertically.

The terminal blocks shall be cage clamp type, 2 conductors disconnect ("knife" type) with test points or 4 conductors disconnect and shall allow plug-in resistor modules for HART communication or fuse modules for outputs to solenoid valves.

All conductors shall be terminal connected.

3.1.4 System cabinets

System cabinets design requirements are listed in **GS INS 134**.

3.1.5 Cable trays

Cables shall always be run on cable trays.

Different cables trays shall be installed as per signals segregation requirements.

Cables shall be arranged in three layers at the maximum.

20 % spare capacity shall be provided in cable trays.

3.2 Pneumatic links

3.2.1 Installation

Outside buildings for offshore installations, pneumatic pipes should preferably be of **AISI 904 L** stainless steel to avoid problems of corrosion; particular attention shall be paid to pipe supports and fixings to avoid areas in which sea water can stagnate.

Onshore, tubes shall be of **AISI 316 L** stainless steel.

Downstream of headers, connections shall be via compression ring couplings.

The use of PTFE tape shall be prohibited.

Plastic pipes shall be used only inside buildings and in automatic control cabinets.

Tube entries into junction boxes and cabinets shall be via the bottom.

3.3 Hydraulic links

Hydraulic links shall be selected from a piping class according to their service pressure.

The installation, support structure and identification system shall be the same as for pneumatic links.

Special attention shall be paid to the cleaning and passivation of the hydraulic lines. Hydraulic lines shall be flushed to reach level 6 cleanliness according to **NAS 1638**.

3.4 Optical fibre links

3.4.1 Short links

Short length optical fibre network related to the Control System shall be designed and supplied by the Control System manufacturer.

3.4.2 Long links

These links shall be managed by Telecommunications specialists.

Although Control System data can be combined with telecommunication means in the same fibre-optic cable, redundant dedicated fibres shall be kept for process data and safety data.

Particular attention shall be paid to the split of instrument and telecom fibres so that instrument links will not be interrupted or disturbed in case of need for troubleshooting or any other intervention on telecom links.

4. Separation of electric and electronic signals

Signals within cables or conduits shall be segregated following their nature and magnitude:

- analogue signals,
- on/off control signals,

- on/off input signals,
- low level signals,
- instrument power supplies,
- ...

In addition they shall be grouped according to the part of the Control System they belong to:

- Process Control System,
- Process Shutdown System,
- Safety Shutdown System,
- Fire and Gas System.

This separation principle shall be applied to junction boxes, multicore cables and cabinets.

Intrinsic Safety signals shall be routed separately and shall respect the above principle.

5. Identification of instrument lines

5.1 General

All components shall be identified by a stainless steel label attached by stainless steel straps.

All lines shall be identified at both ends and at each side of wall penetrations.

Inside the distribution frames, space permitting, for each conductor the identification shall include the identification of the instrument in addition to the terminal number.

Pipe outlets from a manifold to an instrument shall be identified.

Short, positioner/valve actuator type lines shall not be identified.

Inside junction boxes, each pipe shall be individually identified by the name of the instrument.

5.2 Component identification principles

Component identification codes shall include three fields:

- First optional field: "Location" on up to four characters.
- Second field: "Description" on up to four letters, encoded according to the table in Appendix 1.
- Third field: "Serial number" on three digits.

Example:

Identification										
Location				Description				Serial no.		
x	x	x	x	I	B	S	A	1	8	0
x	x	x	x		M	D		0	0	1
x	x	x	x		X	D	O	1	0	1

IBSA180: Intrinsic safety, Junction box, Safety Shutdown System, Analogue signal, No. 180.

MD001: Marshalling cabinet, Process Shutdown System, No. 001.

XDO101: Terminal strip, Process Shutdown System, Digital Output, No. 101.

5.3 Line identification principles

These are identified by the letter of the component (C for cable and T for tube...) followed by an identification of the component they are originating from (direction is from field instrument to final control unit).

Examples are given in Appendix 2.

5.4 Terminal strips identification principles

These are identified using the letter of the component "X" followed by the identification of the cable which is connected to (without the letter "C").

This can be amended when several individual cables are grouped onto the same terminal strip.

Examples are given in Appendix 2.

6. Instrument tubing class

6.1 General

Instrument links shall be made of stainless steel thinwall tubing (AISI 904 L offshore and AISI 316 L onshore).

Particular attention shall be paid to handling and protection of instrument piping during construction activities.



Instrument piping must be supported in such a way that corrosion points will be avoided. Links longer than 1 metre shall be correctly supported and protected.

Tubes shall preferably be secured to the trays using hydrophobic fastening blocks. In all cases the method of support and fastening shall be submitted to the COMPANY for approval.

Instruments and process piping classes are correlated in Appendix 3. For all other conditions approval shall be obtained.

6.2 Use of piping class

When a process fluid exists in instrument connections such as:

- level gauge glass
- level switch
- level torque tube
- etc.

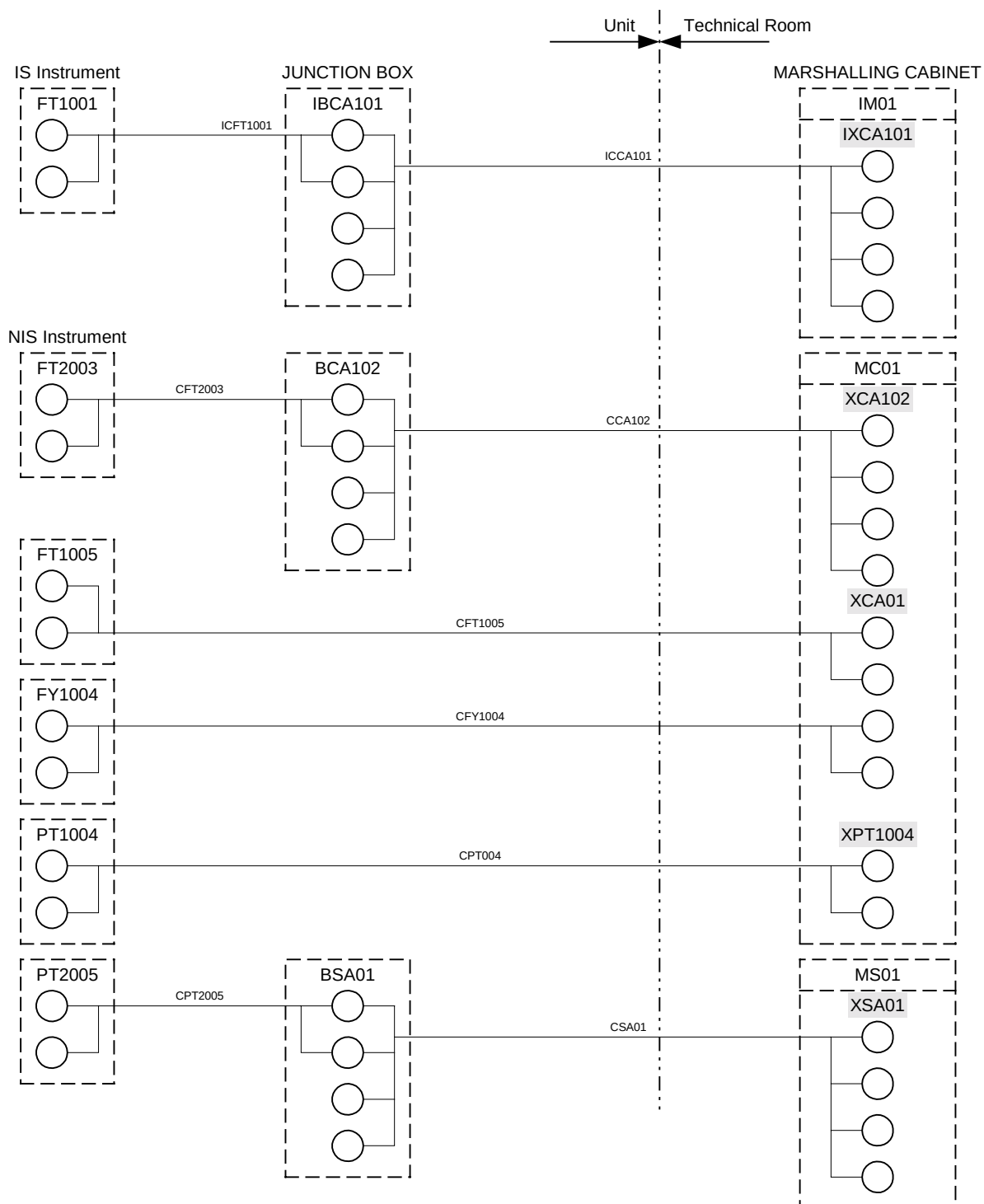
then the tubing class shall be strictly in compliance with the process piping class as defined in General Specification **GS PVV 112**.



Appendix 1 Table of "Descriptive" field codes for identification

	Prefix	1st rank Element	2nd rank System	3rd rank Type
A				Analogue Input/Output
B		Junction Box		
C		Cable	Process Control System	
D			Process Shutdown System	
E			Electrical Power Supply	
F		Optical Fibre		
H			Hydraulic	
I	Intrinsic Safety			Digital Input
L				Low-Level Signal
M		Marshalling Cabinet		
N				Network
O				Digital Output
P			Pneumatic	
R			Fire & Gas System	Return
S		System Cabinet	Safety Shutdown System	Supply
T		Tube	Telecom	
U		Unit Control Panel		
X		Terminal Strip		

Appendix 2 Instrumentation line identification principles



Appendix 3 Instrument Tubing Classes

I01 – INSTRUMENT TUBING SPECIFICATIONS

					PROCESS CONDITIONS:			
ASSEMBLY TYPE: Thinwall tubing and compression fittings					150 #, 300 #, 600 # (and 900 #, 1500 # production water P < 200 barg)			
BASE MATERIAL: Stainless steel					PRESSURE AND TEMPERATURE FOLLOWING ANSI B 16.5			
COMPONENT	SIZE	RATING	CONNECTION	TYPE	PACKING BOX MATERIAL	REFERENCE STANDARDS		NOTES
						Production P-F	Drilling P-F	
INSTRUMENT BALL VALVE	1/4" to 3/4"	3000 psig	OD	Ball type; end entry; full bore; forged SS 316L body; SS 316 ball; ball seals: Viton O-rings	Graphite	AISI F 316L	AISI F 316L	1
INSTRUMENT PLUG VALVE	1/4" to 1/2"	3000 psig	OD	Forged SS 316L body, Non-rotating stem.	Graphite	AISI F 316L	AISI F 316L	
INSTRUMENT GAUGE VALVE	1/2"	6000 psig	Inlet 1/2" NPT(M) Outlet 1/2" NPT(F)	Bar stock SS 316L body x 1 male inlet x 3 female outlets	Graphite	AISI F 316L	AISI F 316L	
INSTRUMENT COMPACT MANIFOLD	1/2"	6000 psig	NPT	With bypass, 3 or 5-valve, with or without drains, 1/2" NPT female inlets, fixed flanged or 1/2" NPT female outlets	Graphite	AISI F 316L	AISI F 316L	1
FLANGE	3/4"	According to Piping Class	Threaded 3/4" NPT	Flange to compression fitting connector Flange and gasket type and material according to Process Piping Class		ANSI B16.5	ANSI B16.5	1
FITTING	1/4" to 3/4"			For thinwall tubing, of forged SS, twin ferrule compression-type, Swagelok or Gyrolok style		AISI F 316L	AISI F 316L	1
UNION	1/4" to 2"	3000 psig	NPT	3 parts, forged SS		AISI F 316L	AISI F 316L	1
PLUG / CAP	1/4" to 1"	3000 psig	NPT	Forged SS		AISI F 316L	AISI F 316L	1
TUBE	1/4" to 1" 1/2"	Sch. 80S to Sch. 160S		Seamless drawn SS		AISI TP 316L with Mo >2.5%	AISI TP 904	1, 3
THINWALL TUBING	1/4" OD to 1/2" OD	0.049" thick		Seamless drawn SS		AISI TP 316L with Mo >2.5%	AISI TP 904	2

- Notes
- 1) Screwed assemblies shall be mounted with COMPANY accepted fibre reinforced sealing compound.
 - 2) Elbows shall be made by bending, following standards and with adequate bending tools. Compression fittings shall be at least 2" from bends.
 - 3) Bending prohibited; use 90° Female elbows.



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Appendix 3

109 – INSTRUMENT TUBING SPECIFICATIONS

					PROCESS CONDITIONS:			
ASSEMBLY TYPE: 1/2" Sch. 160S pipe with threaded fittings					900#, 1500#			
BASE MATERIAL: Stainless steel					PRESSURE AND TEMPERATURE FOLLOWING ANSI B 16.5			
COMPONENT	SIZE	RATING	CONNECTION	TYPE	PACKING BOX MATERIAL	REFERENCE STANDARDS		NOTES
INSTRUMENT BALL VALVE	1/2"	1500#	SW	Ball type; end entry; full bore; forged SS 316L body; SS 316 ball; ball seals: Viton O-rings	Graphite	AISI F 316L	AISI F 316L	1
INSTRUMENT PLUG VALVE	1/2" to 3/4"	5000 API	NPT	Needle valve; Y shaped SS 316 body, 1/2" male in, 1/2" female out (Kerotest type); steel needle, seat seal F6	Graphite	AISI F 316L	AISI F 316L	1, 2
INSTRUMENT GAUGE VALVE	1/2" to 3/4"	6000 psig	Inlet 1/2" NPT(M) Outlet 1/2" NPT(F)	Bar stock SS 316L body x 1 male inlet x 3 female outlets	Graphite	AISI F 316L	AISI F 316L	1
INSTRUMENT COMPACT MANIFOLD	1/2"	6000 psig	NPT	With bypass, 3 or 5-valve, with or without drains, oval flanges inlets, fixed flanged outlets	Graphite	AISI F 316L	AISI F 316L	3
FLANGE	3/4"	900# to 1500#	Outlet 3/4" OD	Flange to compression fitting connector Flange and gasket type and material according to Process Piping Class		ANSI B16.5	ANSI B16.5	7
FITTING	1/2"	3000 psig or 6000 psig		Forged SS		AISI F 316L	AISI F 316L	1, 6
UNION	1/2"	3000 psig or 6000 psig		2 or 4 bolt forged SS flanges, tapered seat, lapped seals, integral seat		AISI F 316L	AISI F 316L	5
PLUG / CAP	1/4" to 1"	3000 psig or 6000 psig	NPT	Forged SS		AISI F 316L	AISI F 316L	1
TUBE	1/2	Sch. 160S		Seamless drawn SS		AISI TP 316L with Mo >2.5%	AISI TP 904	1, 4
THINWALL TUBING	1/4" OD to 1/2" OD	0.049" thick mini		Seamless drawn SS thickness > 0.049" according to P and T		AISI TP 316L with Mo >2.5%	AISI TP 904	8

- Notes
- 1) Screwed assemblies shall be mounted with COMPANY accepted fibre reinforced sealing compound.
 - 2) Use these valves to build manifolds above 150 barg.
 - 3) Oval inlet flanges shall be welded onto 1/2" process taps.
 - 4) Bending prohibited; use 90° Female elbows.
 - 5) Use 2 bolt flanged union, 1/2" 3000 psig rated up to 150 barg and 4 bolt flanged unions, 1" 6000 psig rated from 150 to 250 barg (with 1" x 1/2" reducer).
 - 6) Use 3000 psig rated fittings up to 150 barg, 6000 psig rated fittings from 150 to 250 barg.
 - 7) Use 900# rated flanges up to 150 barg, 1500# rated flanges from 150 to 250 barg.
 - 8) Use the I01 instrument piping class for production water (P < 200 barg).