



GS 140-1

GLYCOL DEHYDRATION UNIT

August 1993

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BP GROUP RECOMMENDED PRACTICES AND SPECIFICATIONS FOR ENGINEERING											
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SCOPE AND PURPOSE This document specifies the minimum requirements for the design of Glycol Dehydration Units. Its purpose is for the specification of fit-for-purpose Glycol Dehydration Units at minimum cost.											
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FOREWORD

Introduction to BP Group Recommended Practices and Specifications for Engineering

The Introductory Volume contains a series of documents that provide an introduction to the BP Group Recommended Practices and Specifications for Engineering (RPSEs). In particular, the 'General Foreword' sets out the philosophy of the RPSEs. Other documents in the Introductory Volume provide general guidance on using the RPSEs and background information to Engineering Standards in BP. There are also recommendations for specific definitions and requirements.

Value of this Guidance for Specification

This Guidance for Specification was developed under the BP Exploration XEU Simple Specifications Initiative. This initiative is intended to simplify the purchasing requirements through a minimum conditions of satisfaction approach in regions where there is a mature supplier resource.

Application

This Guidance for Specification is intended to guide the purchaser in the use or creation of a fit-for-purpose specification for enquiry or purchasing activity.

Text in italics is Commentary. Commentary provides background information which supports the requirements of the Specification, and may discuss alternative options. It also gives guidance on the implementation of any 'Specification' or 'Approval' actions; specific actions are indicated by an asterisk (*) preceding a paragraph number.

This document may refer to certain local, national or international regulations but the responsibility to ensure compliance with legislation and any other statutory requirements lies with the user. The user should adapt or supplement this document to ensure compliance for the specific application.

Specification Ready for Application

A Specification (BP Spec 140-1) is available which may be suitable for enquiry or purchasing without modification. It is derived from this BP Group Guidance for Specification by retaining the technical body unaltered but omitting all commentary, omitting the data page and inserting a modified Foreword.



Feedback and Further Information

Users are invited to feed back any comments and to detail experiences in the application of BP RPSE's, to assist in the process of their continuous improvement.

For feedback and further information, please contact Standards Group, BP International or the Custodian. See Quarterly Status List for contacts.



1. INTRODUCTION

1.1 Scope

This document specifies BP's general requirements for glycol dehydration units.

It is intended for use in conjunction with a functional specification and associated data sheets and drawings which give specific project requirements.

1.2 Quality Assurance

Verification of the vendor's quality system is normally part of the pre-qualification procedure, and is therefore not specified in the core text of this specification. If this is not the case, clauses should be inserted to require the vendor to operate and be prepared to demonstrate the quality system to the purchaser. The quality system should ensure that the technical and QA requirements specified in the enquiry and purchase documents are applied to all materials, equipment and services provided by sub-contractors and to any free issue materials.

Further suggestions may be found in the BP Group RPSEs Introductory Volume

2. GENERAL REQUIREMENTS

2.1 Vendor's Standards

In general, the Vendor's normal standards shall be used for the design and construction of the unit, except where overridden by standards referred to in this document or associated project documentation.

The Vendor shall explicitly refer in his documentation to all applicable standards used.

2.2 Weather Protection

The unit, and in particular any associated electrical equipment and control panels, shall be provided with the appropriate degree of weather protection for long-term use. The location and environment will be stated by the Purchaser. Whether or not under cover, the unit shall be designed to shed rain/fire water and prevent any accumulation of standing water. It shall also be arranged to allow removal of all debris from construction and periodic maintenance, without dismantling of components.



3. PROCESS/SYSTEM DESIGN

3.1 Absorption

The absorbent for water removal from gas shall be tri-ethylene glycol (TEG) unless the Vendor can demonstrate that an alternative medium offers significant advantages. This specification is based on the use of TEG.

If the gas composition contains aromatics then account must be taken of this in the design. Aromatics are absorbed by the glycol and emitted as vapour from the reboiler stripping column, which causes a hazard to platform personnel when it emerges from the atmospheric vent. If the aromatic compounds are at trace level, it may be sufficient to include a condenser and recovery vessel in the glycol regeneration unit. If the levels are more significant, an alternative drying process such as DRIZO (TM) may be required. The presence of aromatics does not adversely affect dehydration performance - in fact, it enhances it.

The lean glycol temperature at entry to the contactor shall be such that the glycol in the contactor is at least 10°C. above the process gas inlet temperature, in order to avoid condensing any of the gas and cool enough to minimise glycol losses.

The contacting medium for absorption of water from the process gas will normally be structured packing. This is capable of high efficiency and low turndown rates.

Experienced vendors of structured packing currently include Glitsch, Koch, Muntz and Sulzer. Glycol flow density of order 17 m³/h per m² of tower cross-sectional area, and turndown to 10% of design flow without maldistribution of either gas or liquid, should be achievable.

The turndown requirement stated within the data sheets shall be achieved in addition to meeting the other unit performance requirements.

3.2 Glycol Regeneration

The regeneration unit design shall be such as to minimise glycol losses, and in any case not to exceed the levels defined in the data sheets. To this end, the temperature of the regenerator still column exit gas must be minimised.

3.3 Glycol Heat Exchange

Maximum economic use shall be made of heat exchange between the rich and lean glycol.



3.4 Glycol Filtration

The unit shall include filtration units to remove:-

- (a) solid particles,
- (b) glycol degradation products, in order to reduce foaming in the contactor.

The filters operate best warm, and shall be placed downstream of the glycol heat exchanger unless the Vendor can demonstrate overriding benefits for an alternative location.

The solid particle filters shall be 2 x 100%, arranged so that the cartridge can be changed on the off-line filter without affecting unit operation. Single-cartridge type filters are preferred, for ease of cartridge replacement. Particle removal performance shall be determined by the need to prevent blockage or build-up in downstream equipment.

The filter for degradation products should operate on a slipstream of at least 10% of the glycol flow.

Solid particles in the glycol tend to block the carbon filter and it is believed that they also promote degradation of the glycol by acting as nucleation sites.

Some vendors put the filters upstream of the exchanger, because the hot stream may have metallurgical implications in the design of the filter vessels. However, this slightly reduces the filter effectiveness.

3.5 Chemical Injection

The unit shall include provision for injection of the following chemicals: antifoam (emergency use only), corrosion inhibitor and pH control. The latter two functions may be combined in one chemical.

The degree of on-skid chemical injection provision (tanks, pumps, etc.) will be project-specific and will be described as necessary by the Purchaser.

3.6 Fire Relief

Fire relief devices shall be sized to [API RP 520](#), App D. The phase change in the fluid subjected to fire heat input, and the phase of the fluid passing through the relief valve, should be considered when determining the relief rate.



3.7 Drains and Vents

All regeneration unit drains and vents shall be continuously piped to the skid edge.

3.8 HP/LP Interfaces

Relief facilities in the lower pressure-rated parts of the unit shall be sized to take account of the maximum possible rate of gas blowby from areas of higher operating pressure, and if necessary to take two-phase flow at this rate. The relief system design basis must take account of the dynamics of the system. All relief calculations must be available for inspection by the Purchaser.

3.9 Depressuring

Emergency depressuring valves and piping to skid edge shall be provided to enable depressuring of all gas inventory down to 6.9 barg or half the operating pressure, whichever is the lesser, within 15 minutes. The appropriate piping and gasket materials shall be used downstream of the depressuring valves to handle the low temperatures which will result.

3.10 Control and Shutdown

The unit shall be designed for automatic operation and automatic safe shutdown without operator intervention.

Facilities (push-button) shall be provided for shutting down the whole unit safely from a remote location. The on-skid part of these facilities shall be provided by the Vendor, with cabling run to appropriate junction sites at the skid edge.

3.11 Instrumentation

The Vendor shall provide all local instrumentation which is necessary for normal operations, start-up and shutdown, plus those extra sensors or sensor insertion points which in his judgement are necessary to perform common diagnostic tests, in the event of maloperation of the plant, without shutting down the plant.

No detailed stipulations are made in this Specification as to the instrumentation required within the regeneration unit, on the basis that the selected Vendor is competent and experienced in the design of glycol dehydration plants.

Any instrumentation which is needed beyond the Vendor's standard provision will be discussed with the Vendor upon receipt of his P&ID at the quotation stage.



However, additional instrumentation is generally to be discouraged on cost grounds.

4. EQUIPMENT DESIGN

4.1 Contactor Tower

4.1.1 The contactor tower height and diameter shall be the minimum required for the duty, taking into account the best available data on the performance of structured packing.

4.1.2 For correct functioning of the contactor, the inlet gas must be free of liquid, either in bulk form or in droplets. To this end, a liquid scrubbing section shall be included in this package.

Design of the inlet device, the liquid coalescing device and certain internal dimensions in this scrubbing section, which have been developed with the aid of both laboratory and full-scale site testing should be incorporated in this package. The essential parameters of the liquid scrubbing section should therefore be given in the project drawing attached to the Specification.

4.1.3 A contactor inlet vapour distributor will normally also be required, and will generally take the form of a perforated pipe.

Even where this is not needed, tangential inlets shall not be used, because they cause maldistribution of vapour in the packing.

4.1.4 The contactor tower design shall be such as to minimise glycol losses. In particular, the contactor column liquid distributor shall be designed so that the drip tubes extend to within approx. 10 mm of the packing surface (not the hold-down plate surface).

This is to minimise the free fall of liquid glycol and hence the entrainment of liquid droplets into the outlet gas stream. Acceptable losses of 25 litres per million sm^3 of gas processed (0.2 US gall per MMSCF) have been quoted in the North Sea, but lower figures may be achievable. Contactor tower demister pads and catch pots have traditionally been specified, but when using structured packing with a properly designed liquid distributor, these should not be necessary.

4.1.5 The liquid distributor shall be hydraulically tested by the vendor before delivery. The variance between the liquid outlet flows shall be less than 8% of the mean value.

Qualified Vendor supervision shall be provided for installation of the contactor tower packing and for on-site levelling of the liquid distributor. Distributor level tolerances are critical: the maximum acceptable vertical out-of-level is 2 mm.



- 4.1.6 Where the preferred double-acting glycol pumps (see 4.2 below) are not used, and the draw-off is therefore not from the liquid gas interface, then a separate draw-off point with manual valve should be provided for periodic disposal of any condensate which collects on the glycol surface. The draw-off nozzle should be at least 40 mm bore.

4.2 Glycol Pumps

Double-acting, rich glycol driven pumps are preferred for glycol circulation, where contactor pressure makes this feasible.

The Vendor must state the minimum gas pressure required in the contactor tower to operate the pumps, both with and without glycol in the tower.

These pumps can be supplied by Kimray (USA), and offer the following advantages: no electric power supply to pump motors, no need for level controls or alarms/trips at base of contactor tower, reduced gas blowby flow for relief design. When no process gas pressure is available to maintain circulation, nitrogen can be used.

- 4.2.3 One fully operational spare glycol pump shall be provided.
- 4.2.4 The glycol pumps/drivers shall be capable of achieving a reasonable circulation rate with cold glycol at start-up, taking into account the viscosity of TEG at temperatures down to -5°C.
- 4.2.5 The Vendor shall carry out a dynamic analysis of the glycol pumping system to identify any need for pulsation dampers.

4.3 Glycol Surge Drum

The glycol surge drum volume shall be no greater than that needed to contain volume changes due to thermal expansion (from the ambient shutdown condition to maximum gas throughput) and glycol inventory changes in the contactor as gas flow increases. High and low level alarms should be set to maximise the useful volume of the drum for a given diameter.

Glycol inventory should be minimised, to reduce regeneration time after an upset.

4.4 Glycol Reboiler

- 4.4.1 Reboiler high level instrumentation shall be set high enough to avoid spurious trips caused by the effect of stripping gas on reboiler level.
- 4.4.2 The regeneration unit shall be designed to minimise glycol degradation. In particular, the reboiler temperature controller must be capable of holding the glycol temperature steady to within $\pm 1^{\circ}\text{C}$.



This is because the optimum TEG regeneration temperature is 204°C, but chemical degradation of TEG starts to become significant above 206°C.

4.4.3 The still column will normally be provided with random packing.

4.4.4 If the regeneration unit is direct-fired, refer to BP Group [GS 122-1](#) for Purchaser's detailed fixed heater specifications.

This will normally only apply to onshore units,

4.5 Heat Exchangers

A cleanliness factor of no more than 85% shall be applied to the calculation of the required surface area for the glycol heat exchangers.

5. PACKAGE DESIGN

5.1 Dimensions

* Overall vessel/skid dimensions must not exceed the constraints specified by the Purchaser.

5.2 Insulation

Insulation for heat conservation purposes should be confined to vessels only. Insulation for personnel protection should be provided only where absolutely necessary and where other means of operator protection are not practicable. In general, insulation of small-bore piping should not be carried out by the Vendor, unless instructed otherwise by the Purchaser.

Lagging tends to obstruct commissioning activities, and is frequently removed anyway at this stage.

5.3 Transportation

The mechanical design of the package should be checked against loads imposed by transporting the package to its eventual site.

Transportation loads are specified by the Purchaser.

This requirement is principally to cover offshore design, where the unit may be subjected to abnormal loads during load-out. It may also be tested full of glycol at the fabrication yard. In this case, leaving it liquid-full can save significant time, material cost and effort at a critical stage in construction. However, the implications for skid structure design will have to be checked.



5.4 Pipework

- 5.4.1 On-unit flanging should be minimised, but shall be provided on all equipment items and automatic valves.
- 5.4.2 Tapping points shall be provided at the lowest point on the regeneration unit (normally the surge drum) for drawing off or filling with glycol.
- 5.4.3 Rich and lean glycol sampling points shall be provided adjacent to the contactor. Where piping from the contactor to the regeneration unit is provided by the Purchaser, these sampling points will also be provided by the Purchaser.
- 5.4.4 Regeneration unit closed drains will be piped into a single header, sloped to the skid edge at a minimum slope of 1:50.

5.5 Electrical and Instrumentation

- 5.5.1 Electrical and instrumentation design of the unit shall be in accordance with the general Project requirements for vendor packages.

6. OPERATIONS AND MAINTENANCE

- 6.1 The regeneration unit layout shall permit safe and efficient operational access to all valves and instruments, e.g. without having to step over small-bore piping.
- 6.2 Reasonable separation shall be maintained between major vessels, to permit operator access. Where this applies, a minimum of 0.5 m horizontal clearance must be provided at the narrowest point of passage between the fittings on the vessels.
- 6.3 The unit layout shall permit access for the following operations/maintenance activities without the need to dismantle pipework or cabling on adjacent subsystems:-
 - withdrawal of exchanger plates/tubes for cleaning
 - replacement of filter cartridges
 - removal of glycol pumps for overhaul
 - removal of instruments and automatic valves for overhaul
 - removal of other individual equipment items for overhaul.



DEFINITIONS AND ABBREVIATIONS

Definitions

Standardised definitions may be found in the BP Group RPSEs Introductory Volume.

Abbreviations



LIST OF REFERENCED DOCUMENTS

A reference invokes the latest published issue or amendment unless stated otherwise.

Referenced standards may be replaced by equivalent standards that are internationally or otherwise recognised provided that it can be shown to the satisfaction of the purchaser's professional engineer that they meet or exceed the requirements of the referenced standards.

International

[API RP 520](#) Sizing, Selection and Installation of Pressure-Relieving Devices
- Part 1.

BP Group Documents

BP Group [GS 122-1](#) Fired Heaters to API 560

