

GENERAL SPECIFICATION

PROCESS

GS EP ECP 101

Glycol package unit

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1. Scope

1.1 Purpose of the specification

This specification details Company's minimum requirements for the design, manufacture and performance of Tri Ethylene Glycol (TEG) gas dehydration package units.

This general specification does not remove the responsibility of the Vendor who will outline in his technical proposal any deviation to the clauses of this specification and will guarantee the unit performance in the long run.

1.2 Applicability

This document is concerned with glycol package units with conventional generation process to be installed either offshore or onshore. It does not cover other gas dehydration technologies. It does not cover either licensed TEG regeneration units. Specific requirements from licensors generally prevail.

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
API 674	Positive Displacement Pumps - Reciprocating
GPSA	Engineering Data book GPSA vol II chapter 20 (11 th edition 1998)

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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 ECP 103	Process sizing criteria
GS EP ELE 011	Electrical requirements for packaged units
GS EP INS 110	Instrumentation for package units
GS EP MEC 028	Rotating Machine Package Specification - Positive Displacement Motopump according to API Standard 674
GS EP PVV 415	Design and fabrication of air cooler
GS EP PVV 813	Skid mounted units for static equipment
GS EP SAF 216	Area classification
GS EP SAF 227	Safety rules for fired heaters
GS EP SAF 228	Liquid drainage
GS EP SAF 261	Emergency Shutdown and Emergency De-Pressurisation (ESD & EDP)
GS EP SAF 262	Pressure protection relief and hydrocarbon disposal systems
GS EP SAF 311	Rules for the selection of fire-fighting systems
GS EP STR 103	Design and fabrication of skids and equipment supporting structures

Others documents

Reference	Title
Oil and Gas Journal	(March 29, 1993)

3. General

3.1 Terminology and definitions

There are five types of statement in this specification, the "shall", "should", "may", "can" and "must" statements. They are to be understood as follows:

Shall	Is to be understood as mandatory. Deviating from a "shall" statement requires derogation approved by Company.
Should	Is to be understood as strongly recommended to comply with the requirements of the specification. Alternatives shall provide the same level of protection or performance and this shall be documented.
May	Is to be understood as permission.
Can	Is to be understood as a physical possibility.
Must	Expresses a regulatory obligation

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3.2 Acronyms

BDV	Blow Down Valve
F&G	Fire and Gas
HC	HydroCarbon
LAH	Level Alarm High
LAL	Level Alarm Low
LCV	Level Control Valve
LP	Low Pressure
LSHH	Level Safety High High
LSLL	Level Safety Low Low
NLL	Normal Liquid Level
P&ID	Piping and Instrumentation Diagram
PFD	Process Flow Diagram
PSV	Pressure Safety Valve
RTD	Resistance Temperature Detector
TAL	Low Temperature Alarm
TEG	Tri Ethylene Glycol
TSHH	Temperature Safety High High
TSLL	Low Low Temperature Safety

3.3 Prevailing requirements

In case of conflict between the inquiry and order, the information included in the order prevails.

In case of conflict between different project documents, the following order of precedence governs:

- Local regulations.
- Material purchase requisition.
- This specification.
- Project-specific specifications and data sheets.
- Discipline engineer's specifications.
- Company's documents.

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3.4 Documents of reference

The package equipment and all accessories shall be designed, fabricated and tested in accordance with the specifications, codes, standards and regulations listed in the purchase requisition.

3.5 Qualifications

Deviations from this general specification shall be itemized with full details of proposed alternatives under the heading "Exemptions to Specification" in Vendor's proposal. Otherwise, it will be deemed that the equipment offered is in full accordance with the referred documents.

3.6 Site environmental conditions

The equipment shall be designed to operate satisfactorily over the entire temperature range and environmental conditions described in the project-specific specification.

3.7 Utilities

All available utilities on the field are as stated in the project-specific specification. Particular requirements regarding the quality or the battery limit conditions of utilities shall be expressed by Vendor in his technical offer.

3.8 Area classification

The equipment shall be suitable for operation in hazardous area Zone 2, Group IIB, Temperature Class T3 as a minimum. Reference is made to [GS EP SAF 216](#), [GS EP ELE 011](#) and [GS EP INS 110](#).

4. Vendor's scope of supply

Vendor's scope of supply shall include, but is not limited to, the following items.

4.1 General

- Engineering services for detailed engineering.
- Procurement activities, material and equipment supply.
- Fabrication and shop erection.
- Shop testing and services of personnel required during testing.
- Inspection, Quality assurance/Quality control.
- Spare parts for commissioning and initial start up.
- Special tools for installation and maintenance if any.
- Packing and marking.
- All documents requested in the purchase requisition which can include additional documents requested by a third party for certification.
- Pre-commissioning, commissioning and start up procedures.

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- Operating and maintenance manuals.
- Mechanical and performance guarantees.

4.2 Main equipment

4.2.1 Feed gas treatment system

The feed gas treatment system is a two stage unit located upstream the TEG contactor. It consists of 1) a knockout drum for bulk liquid removal 2) a filtration and coalescing system for fine solids and liquid droplets removal.

The scope of supply shall include at least the filter-coalescer but may exclude the knock-out drum if provided by others.

4.2.2 Dehydration column

- The gas dehydration column equipped with its internals (structured packing or trays, distributors and mist eliminators)
- All instrumentation and valving
- Insulation supports (to be provided even if no insulation material is provided)
- And insulation material if required

4.2.3 Dry gas treatment system

The dry gas treatment system consists of a filter-coalescer and a cooler. It should be provided in order to minimize glycol losses.

4.2.4 Glycol regeneration skid

Equipment for the regeneration skid shall include as a minimum:

- One flash drum.
- Two cartridge filters with isolation valves (one stand-by).
- One slipstream activated carbon filter.
- One Still Column.
- One integrated reflux condenser or one external reflux condenser with receiver drum and reflux pumps.
- One reboiler, equipped either with fire tubes or electrical bundle.
- One stripping column / one stripping gas injection point (or tie-in provision) if required.
- Rich/lean glycol heat exchanger(s).
- One surge drum.
- N+1 glycol circulation pumps (one stand-by) driven by electrical motors, equipped with necessary pulsation dampeners installed both at suction and discharge.
- One final lean glycol cooler.

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- One glycol make-up facility.
- One closed drain drum with one recycle pump.
- Two chemical injection skids (pH control, antifoam), each consisting of a chemical storage tank and a dosing pump.
- One snuffing system (for fire tube option).

The glycol regeneration unit shall be skid-mounted on steel structure, with all necessary access/maintenance platforms, stairways, handrails and walkways. Reference is made to **GS EP PVV 813** requirements.

In compliance with **GS EP SAF 228**, a drip pan shall be provided underneath the glycol regeneration skid in order to collect all spills and liquid drains. The drip pan shall be provided with a specific valved drain piped (3" minimum) to the edge of the skid at the lowest point. The drain pipe shall be terminated with a flange.

4.3 Miscellaneous

- All on-skid pipework, pipe supports and valves for process, utilities, drains, vents and relief systems and lifting equipment (beams, slings, shackles etc.) in accordance with **GS EP PVV 813** and **GS EP STR 103** requirements
- Ladders and/or platform brackets
- Adequate supports and structure to minimize piping, valves, vessels, structure and instrumentation vibration in accordance with Vendor's vibration study
- All instruments, instrument supports, instrument cabling, instrument air headers, cable and/or pipe trays, unit control panels, fire and gas detectors in accordance with **GS EP INS 110** requirements
- Internal earthing loop, lighting system and heat tracing (where necessary) in accordance with **GS EP ELE 011** requirements
- Painting of complete package
- Thermal insulation material and/or personnel protection means as necessary
- Check points for corrosion inspection through the insulation
- Lifting devices for maintenance
- Provision for fire-fighting systems as defined in the project-specific data sheet or Safety Concept

4.4 Interfaces

Vendor shall provide all materials and equipment listed in this specification (and any other item which may be considered necessary for efficient and simple working and maintenance) completely assembled and ready for hook-up.

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The interfaces at glycol package battery limits are defined as follows:

- Piping: all on-skid process and utilities pipework shall end with a flange at the skid edge.
- Electrical: reference is made to **GS EP ELE 011**.
- Instrumentation and fire and gas detection: reference is made to **GS EP INS 110**.

5. Vendor guarantees

The following items and figures shall be guaranteed by Vendor and will be recorded during a formal performance test. The test duration should be sufficient for a proper assessment of the unit performance in the long term, including solvent make-up rate and operating costs.

5.1 Treated gas water dew point

Vendor shall guarantee the water content of the treated gas for all loads between turndown and design capacity.

5.2 Design flowrates

The performance and the mechanical strength of the TEG column and the TEG regeneration skid shall be guaranteed for 110 % of the specified normal operating capacity.

A turndown ratio of 30% of the normal operating capacity shall be considered unless the project-specific data sheet requires a lower ratio.

5.3 Feed gas filter-coalescer performance

- Maximum pressure drop across the filter should be 0.1 bar in clean conditions
- Removal of 99% of solid particulates with a diameter greater than 1 micron
- Removal of 99 % of liquid droplets with diameter greater than 0.3 microns
- Liquid content of the outlet gas: 5 liters per 10^6 Nm^3 of gas or 5 ppm wt maximum

5.4 Pressure drop/Temperature increase in the contactor

The pressure drop through the glycol contactor shall not exceed 0.5 bar at design conditions.

The gas temperature increase in the glycol contactor shall not exceed 3°C for the normal glycol inlet temperature.

5.5 Glycol process losses – solvent make-up

Vendor shall guarantee the overall glycol process losses for the design conditions. The overall glycol process losses include all forms of glycol loss by entrainment and vaporisation during normal operation (liquid carry-over, TEG vapour loss in treated gas, overhead gases of flash drum and Still Column etc.) but exclude small leaks from valves, pump packing etc. and maintenance drains. Vendor shall give the breakdown of losses by entrainment and vaporisation and indicate which thermodynamic model is used to determine vapour losses.

Glycol process losses by entrainment shall not exceed 10 liters/ 10^6 Nm^3 (0.07 USG/MMSCF) for the contactor, and 4.3 liters/ 10^6 Nm^3 (0.03 USG/MMSCF) for the regeneration skid.

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Note that the dehydration column operating conditions may significantly impact the solvent consumption.

5.6 Utilities consumption

Utilities consumption (electrical power, fuel gas, instrument air, nitrogen etc.) and stripping gas flow rate (if any) shall be guaranteed for the design conditions.

6. Safety requirements

Reference shall be made to the project-specific Safety Concept document for requirements regarding the F&G and fire fighting systems.

The number of flanges on glycol piping shall be minimized.

6.1 F&G detection and fire-fighting

Reference is made to [GS EP SAF 311](#) and [GS EP INS 110](#). The TEG unit fire detectors and fixed fire-fighting equipment shall be integrated within the package boundaries. The detection signals will be transmitted to the main F&G system in the control room.

6.2 Requirements for PSV and depressurisation means

[GS EP SAF 261](#) requirements shall be adhered to.

6.3 Fire heater

In case a fire heater is selected as TEG reboiler, the number of flanges on fuel gas piping shall be minimized. Instruments on reboiler and glycol flash drum, drain points (process and instruments) and flanges shall be located as far as practicable from the combustion air intake.

Reference is made to [GS EP SAF 227](#) for requirements regarding fire heater gas detection, fire-fighting and snuffing systems.

7. Process design requirements

7.1 TEG unit basis of design

7.1.1 Feed gas water content

If the feed gas water content is not given in the project data sheet, the basis for design shall be the maximum water content (saturation) determined by one the following methods:

- The most conservative correlation based upon Vendor know-how for the project-specific conditions (shall be indicated in Vendor's proposal).
- The charts given in the latest edition of the [GPSA](#) with salinity and relative density correction (this value shall be multiplied by 1.1).
- The charts given by Wichert in [Oil and Gas Journal \(March 29, 1993\)](#) with salinity and relative density correction (this value shall be multiplied by 1.1).

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Notes:

- In all cases corrections for acid gas components shall be taken into account
- Water content shall be calculated for the most stringent operating conditions (i.e. minimum pressure and maximum temperature)

7.1.2 Treated gas dew point specification

Vendor should consider adding a 5°C margin on the guaranteed treated gas dew point value because of the penalties attached to this contractual value.

7.1.3 Glycol flow rate

The lean glycol flowrate is a function of the quantity of water to be removed and shall not be lower than the value given in Table 1 for a given raw gas water content.

Table 1 - Determination of TEG flowrate versus feed gas water content

Water content of wet gas			Lean TEG/Removed water ratio	
mg/Sm ³	kg/MMSCF (x 0.0283)	lb/MMSCF (x 0.0624)	kg/kg	USG/lb (x 0.1089)
≥ 5000	≥ 141	≥ 312	15	1.6
3000 - 5000	85 - 141	187 – 312	18	2.0
2000 - 3000	57 - 85	125 – 187	20	2.2
1200 - 2000	34 - 57	75 – 125	22	2.4
800 - 1200	23 - 34	50 – 75	25	2.7
600 - 800	17 - 23	37.5 – 50	27.5	3.0
400 - 600	11 - 17	25 – 50	30	3.3
≤ 400	≤ 11	≤ 25	35	3.8

Furthermore, to ensure sufficient wetting of the structured packing, the glycol flow rate shall not be lower than 1 m³/h/m² of dehydration column area section.

7.1.4 Lean glycol purity

The addition of a stripping column should be considered even if a low lean glycol purity is targeted. Provision for direct stripping gas injection into the reboiler shell shall be implemented for small capacity units.

The lean glycol purity and the number of equilibrium stages in the contactor shall be determined on the assumption that the feed gas is water saturated (reference is made to section 7.1.1 for water saturation method), even if the wet feed gas is not water saturated in project-specific conditions.

The required lean glycol purity for a given treated gas specification shall be determined with a margin of 10°C between the targeted water dew point and the theoretical equilibrium dew point.