

GENERAL SPECIFICATION

PROCESS

GS EP ECP 103

Process design criteria

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General Specification		GS EP ECP 103
Process design criteria		
Rev.: 12	Effective date: 01/2020	Page: 2 of 61

Contents

1. Scope	5
1.1 Purpose of the specification	5
1.2 Applicability	5
2. Reference documents	5
3. General	7
3.1 Terminology and definitions	7
3.2 Abbreviations	9
4. Design conditions	10
5. Piping and equipment design parameters	10
5.1 Design temperature	11
5.2 Design Pressure	13
6. Pipelines and risers design parameters	16
6.1 Temperature	16
6.2 Pressure	18
6.3 Pipeline hydraulic sizing	18
7. Onshore storage	19
8. Floating units	19
9. Material selection	19
10. Vessels	20
10.1 Design	20
10.2 Vapour area and internals	20
10.3 Liquid hold-up time/volume	21
10.4 Production separator ensuring slug catcher service	22
10.5 Liquid hold-up: closed drain drum	23
10.6 Liquid retention time	23
10.7 Level positions	25
11. Heat exchangers	25

General Specification		GS EP ECP 103
Process design criteria		
Rev.: 12	Effective date: 01/2020	Page: 3 of 61

11.1	Temperature approach for heat exchangers	25
11.2	Fouling resistance	25
11.3	Margin on surface area, flowrate and duty	26
11.4	Shell and tubes	27
11.5	Plates and frame	27
11.6	Plate-Fin Heat Exchangers (PFHE).....	28
11.7	Air coolers.....	28
12.	Pumps	28
13.	Compressors	30
13.1	Flowrate	30
13.2	Operating conditions	30
14.	Gas dehydration units (TEG).....	31
15.	Piping and valves	31
15.1	Line sizing	31
15.2	Control valves	37
15.3	Isolation	39
15.4	Thermal insulation, heat tracing and passive fire protection	40
15.5	Nozzles and manholes.....	41
15.6	Liquid drainage	43
15.7	Sampling connections	43
16.	Overpressure protection and relief systems	43
16.1	Overpressure protection.....	43
16.2	Determination of relief loads.....	43
16.3	Depressurisation calculations.....	44
16.4	Thermal radiation and noise level criteria	45
16.5	Flare/vent tip selection	45
16.6	Stack height calculation	46
16.7	Line sizing.....	46
16.8	Knock-out drum sizing.....	49
16.9	Purge gas	51
16.10	Installation.....	53



General Specification		GS EP ECP 103
Process design criteria		
Rev.: 12	Effective date: 01/2020	Page: 4 of 61

17. Simulation and software.....58

General Specification		GS EP ECP 103
Process design criteria		
Rev.: 12	Effective date: 01/2020	Page: 5 of 61

1. Scope

1.1 Purpose of the specification

This General Specification gives the minimum requirements for process design criteria to be used during pre-engineering (Conceptual, Pre-Project) and engineering studies (basic, FEED, detailed).

1.2 Applicability

This General Specification is intended to use in facilities such as oil and gas production plants, gas plants and LNG plants. It is also applicable to Vendor's packages and to pipelines and subsea pipeline systems.

It does not apply to oil sand froth production or subsea process equipment (separator, pump, etc.) which are covered by a project specific process design criteria document.

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 addendums, is the latest revision published at the effective date of this document.

Reference	Title
ALPEMA	The Standards of the Brazed Aluminium Plate-Fin Heat Exchangers Manufacturers' Association, Third edition, May 2012
API RP 14C	Analysis, Design, Installation, and Testing of Safety Systems for Offshore Production Facilities
API RP 14E	Recommended Practice for Design and Installation of Offshore Production Platform Piping Systems
API SPEC 6A	Specification for Wellhead and Tree Equipment
API SPEC 6D	Specification for Pipeline and Piping Valves
API SPEC 12J	Specification for Oil and Gas Separators
API STD 521	Pressure-relieving and Depressuring Systems
API STD 520 PT II	Sizing, Selection, and Installation of Pressure-relieving Devices Part II - Installation
API STD 661	Petroleum, Petrochemical, and Natural Gas Industries - Air-cooled Heat Exchangers
API STD 662 Part 1	Plate Heat Exchangers for General Refinery Services Part 1 – Plate and Frame Heat Exchangers
API STD 674	Positive Displacement Pumps – Reciprocating

General Specification		GS EP ECP 103
Process design criteria		
Rev.: 12	Effective date: 01/2020	Page: 6 of 61

Reference	Title
EI ISO 15547-1	Guidelines for the avoidance of vibration induced fatigue in process pipework, second edition, 2008, Energy Institute, London Plate-type heat exchangers – Part 1: Plate and frame heat exchangers

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published.

Reference	Title
GS EP COR 004	Limiting flow velocities calculations for erosion corrosion purpose
GS EP COR 005	Material selection for oil and gas production systems
GS EP COR 771	Thermal insulation (hot and dual services)
GS EP COR 772	Thermal insulation (cold service)
GS EP ECP 101	Glycol (TEG) package unit
GS EP ECP 105	Process and Flow Assurance deliverables to be prepared by Contractor during engineering phase
GS EP EXP 311	Plant integrity - Minimum inspection requirements
GS EP ICS 002	2D CAD Process Schematics
GS EP INS 101	Instrumentation Design
GS EP INS 106	Instrument Installation
GS EP INS 120	Control Valves
GS EP INS 125	Safety Relief Valves and Rupture Discs
GS EP INS 141	Analysers
GS EP MEC 028	Rotating Machine Package Specification - Positive Displacement Motopump according to API Standard 674
GS EP MEC 253	Anti Surge Systems for Centrifugal and Axial Compressors
GS EP MEC 271	Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries according to API Standard 610
GS EP MEC 292	Rotating Machines Packages Installation Requirements
GS EP PLR 100	Submarine pipeline systems
GS EP PLR 104	Onshore pipeline systems
GS EP PVV 107	Piping Stress Analysis
GS EP PVV 111	Piping design specification
GS EP PVV 112	Piping material classes

Reference	Title
GS EP PVV 119	Design and fabrication of metallic piping supports - Standard for piping supports
GS EP PVV 211	Design and fabrication of pressure vessels according to ASME VIII
GS EP PVV 212	Design and fabrication of pressure vessels according to BSI PD 5500
GS EP PVV 312	Design and fabrication of metallic vertical storage tanks
GS EP PVV 411	Shell and tube heat exchangers
GS EP PVV 412	Plate heat exchanger
GS EP PVV 415	Design and fabrication of air cooler
GS EP PVV 551	Flare tips
GS EP SAF 228	Liquid drainage
GS EP SAF 253	Impacted area, restricted area and fire zones
GS EP SAF 260	Design of High Integrity Protection Systems (HIPS)
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 321	Fire pump stations and fire water mains
GS EP SAF 337	Passive Fire Protection: basis of design
GS EP SAF 341	Location and protection of onshore hydrocarbon storage

3. General

3.1 Terminology and definitions

For the purpose of this specification, the following definitions apply:

Block valve: type of valve that can block flow in both directions. It includes full bore gate or ball valve.

Cryogenic service: service with design temperature ranging from minus 46 °C to minus 196 °C and continuous operating service temperature below minus 41°C (GS EP PVV 112).

Design pressure: pressure, together with the design temperature, used to determine the minimum permissible thickness or physical characteristic of each component, as determined by the design rules of the pressure design code.

Fully rated design: the system design conditions are above the maximum operating conditions of all possible sources.

Maximum design temperature: internal upper temperature used for the system mechanical design. Fire conditions are not taken into account.

Maximum/Minimum Operating Pressure/Temperature (MOP, MinOP, MOT, MinOT): these are the expected operating envelopes for pressure/temperature out of which product

General Specification		GS EP ECP 103
Process design criteria		
Rev.: 12	Effective date: 01/2020	Page: 8 of 61

specifications or system performance are not maintained. Maximum/minimum operating pressure/temperature are the upper/lower boundaries of the normal operating range and correspond to high/low alarm set points (several sets of alarm may coexist, e.g. for cyclic process like molecular sieves regeneration). MinOT excludes the emergency depressurisation.

Minimum design temperature: internal lower temperature used for the system mechanical design and material selection.

Minimum wall temperature: this is the lowest temperature the equipment wall can reach. It takes into account the lowest temperature reached during emergency depressurisation, LPG or refrigerant fluid atmospheric boiling point, etc.

Normal operating conditions: these are the range of possible internal pressure, temperature, flow rate and fluid composition in stable steady state conditions considering seasonal changes, production changes during facility lifetime, etc. Normal operating conditions are required to maintain product specifications and system performance.

Normal Operating Pressure/Temperature (normOP, normOT): it is the highest (positive) or the lowest (negative) normal operating pressure/temperature amongst all steady state process cases (used to generate the heat and material balances).

Piping and Instrumentation Diagram (P&ID): it is the detailed drawing used for process design, operability and safety studies, assistance to construction and operation of the processing plant including associated off sites and utility fluids. P&ID's symbols are used for a good understanding and also in order to simplify the representations on P&ID's. Refer to [GS EP ICS 002](#) and [GS EP ECP 105](#).

Plate heat exchangers: This terminology includes:

- Plate and frame heat exchangers according to [API STD 662 Part 1](#) / [ISO 15547-1](#),
- Welded plate block heat exchangers,
- Shell and plate heat exchangers,
- Printed circuit heat exchangers.

Process data sheet: it is the data sheet for all itemised equipment/package or valves/instruments (control valves, PSV's, rupture disks, flow meters, orifices, etc.) containing the process information required for sizing including sketches with main dimensions such as internal diameter, length, liquid levels for vessels and columns. It is issued by Process discipline. Refer to [GS EP ECP 105](#). The information given in the process data sheets are also used in the "mechanical data" sheet, issued for the purchasing of the said equipment.

Process Flow Diagram (PFD): it presents the succession of operations in the fluid(s) processing to reach the required products specifications including associated off sites. Refer to [GS EP ICS 002](#) and [GS EP ECP 105](#).

Process rated flow: for rotating equipment, this is the specified operating point with the highest flow. This is not to be confused with the machine rated flow which is defined in the relevant rotating machine code. For packages, this is the net design flowrate (i.e. recycle within the package, package internal consumption, etc. are not included).

Retention time: time necessary for the phase separation to operate properly in a separator.

Hold-up time/capacity: time/volume necessary for the level control in a separator.

Settle-out pressure: highest pressure which the compressor experiences when not running after isolation and equilibrium has been reached. It is a function of the compressor isolable section arrangement (piping volume, etc.).

Temperature approach: the smallest temperature difference between the hot and the cold stream in a heat exchanger.

Toxic and lethal fluid: refer to [GS EP SAF 253](#).

Utility Flow Diagram (UFD): equivalent of PFD for utilities generation and distribution systems. Refer to [GS EP ECP 105](#).

3.2 Abbreviations

AIV	Acoustic Induced Vibration
BAHX	Brazed Aluminium Heat Exchanger
BDV	Blow Down Valve
BTU	British Thermal Unit
CFD	Computational Fluid Dynamics
CFU	Compact Floatation Unite
C_p	Specific heat at constant pressure
C_v	Specific heat at constant volume
CWHE	Coil Wound Heat Exchanger
D	Internal diameter
EDP	Emergency Depressurisation
EOR	Enhanced Oil Recovery
EOS	Equation Of State
FEED	Front End Engineering Design
FIV	Flow Induced Vibration
FSHH	Flow Safety High
HIPS	High Integrity Protection System (Refer to GS EP SAF 260)
ILAH	Interface Level Alarm High
ILAL	Interface Level Alarm Low
ILSHH	Interface Level Safety High
ILSLL	Interface Level Safety Low
INLL	Interface Normal Liquid Level
J-T	Joule-Thompson

KO Drum	Knock-Out Drum
LAH	Level Alarm High
LAHH	Level Alarm High High
LAL	Level Alarm Low
LHV	Lower Heating Value
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LSHH	Level Safety High High
LSLL	Level Safety Low Low
MinOP	Minimum Operating Pressure
MITA	Minimum Internal Temperature Approach
MinOT	Minimum Operating Temperature
MOP	Maximum Operating Pressure
MOT	Maximum Operating Temperature
MSL	Mean Sea Level
MW	Molecular Weight
NA	Not Applicable
NLL	Normal Liquid Level
NPS	Nominal Pipe Size (diameter)
normOP	normal Operating Pressure
normOT	normal Operating Temperature
NPSH	Net Positive Suction Head
NPSH_A	Net Positive Suction Head Available
NPSH_R	Net Positive Suction Head Required

PAH	High pressure alarm
PAL	Low pressure alarm
PCHE	Printed-Circuit Heat Exchanger
PFHE	Plate-Fin Heat Exchanger
PFP	Passive Fire Protection
P&ID	Piping & Instrumentation Diagram
PR	Peng-Robinson EOS (1978)
PRD	Pressure Relieving Device
PSHH	Pressure Safety High
PSV	Pressure Safety Valve
PWL	Sound Power Level (see EI)
RF	Raised Face flange

RJ	Grooved flange, for ring joint
RO	Restriction Orifice
RVP	Reid Vapour Pressure
SDV	Shut Down Valve
SIF	Safety Instrumented Function
SIS	Safety Instrumented System
SRK	Soave-Redlich-Kwong EOS
TAH	Temperature Alarm High
TAL	Temperature Alarm Low
TEG	Triethylene glycol
TSHH	Temperature Safety High
TSLL	Temperature Safety Low
WHRU	Waste Heat Recovery Unit
WHSIP	Well Head Shut-In Pressure

4. Design conditions

{Rule 1:

The mechanical integrity of all process, pipeline and piping systems and their operability shall be maintained under all possible coincident pressure and temperature conditions, with due account of protective barriers.}

{Rule 2:

All modes of operation with associated pressure and temperature conditions shall be described in an auditable document as well as the interface conditions at the project battery limits.}

This document can refer to Process Operating Philosophy, Heat and Material Balances, Calculation Notes of transient operating modes and Flow Assurance interface documents ([GS EP ECP 105](#)).

More than one set of design conditions should be specified if the most severe pressure and temperature cannot occur at the same time. Typical examples are:

- Molecular sieve vessel for which different design conditions should be specified for the adsorption phase and the regeneration phase.
- Equipment subject to steam-out conditions.
- Upset and transient conditions such as start-up, shut-down, etc.

5. Piping and equipment design parameters

This subsection excludes instrument piping and pipelines (refer to 6).

{Rule 3:

The range of operating conditions (MinOT, MOT, MinOP and MOP) to achieve product specifications shall consider all possible conditions such as seasonal changes, or production changes during facility lifetime.}

{Rule 4:

Toxic and lethal service shall be specified on the process component data sheet with the expected composition.}

{Rule 5:

The alarm set points shall be as follows:

- $TAL \geq MinOT$
- $TAH \leq MOT$
- $PAL \geq MinOP$
- $PAH \leq MOP$ }

5.1 Design temperature

{Rule 6:

The design temperatures shall always be defined in combination with the design pressure of the selected operating cases.}

{Rule 7:

The interval between the successive layers of protection (TAH, TSHH and maximum design temperature; TAL, TSL and minimum design temperature) shall be at minimum 5 °C.}

5.1.1 Maximum design temperature

{Rule 8:

The following criteria shall apply:

- **Maximum design temperature to be greater than:**
 - **normOT + 15 °C,**
 - **maximum surface temperature due to external radiations,**
- **The maximum design temperature of the first equipment downstream of a cooler (other than air cooler) to be at least the cooler upstream MOT,**
- **For heat exchangers, the maximum design temperature of the cold side to be at least equal to the MOT of the hot side.}**

Design temperature may have to be increased to take into account the transient operating modes (e.g. pigging, shut-down, restart, steam-out, defrost), cyclic operation (e.g. regeneration, backwash, compressor recycle), turndown conditions, equipment ageing/fouling and upsets.

The exceptional temperature generated by fire is not considered to specify the maximum design temperature.

When Vendor data is not available, the maximum design temperature downstream of an air cooler should be determined considering that 20 % of the duty is provided by natural draft.

5.1.2 Minimum design temperature

{Rule 9:

The following criteria shall apply:

- **Minimum design temperature to be lower than:**
 - **MinOT - 5 °C,**
 - **Minimum wall temperature,**
 - **Minimum ambient temperature,**
- **Equipment handling LPG or refrigerant fluid to be designed for the fluid atmospheric bubble point.**
- **Potential cooling due to gas blow-by from a high pressure system to a low pressure system to be taken into account.}**

The margin between minOT and the minimum design temperature may need to be increased in order to stagger successive layers of protection (TAL, TSL).

See section 16.3.2 for the determination of the minimum wall temperature during depressurisation.

General Specification		GS EP ECP 103
Process design criteria		
Rev.: 12	Effective date: 01/2020	Page: 13 of 61

Derogation related to the minimum wall temperature resulting from depressurisation should be supported at least by:

- Demonstration that there is no possibility to immediately re-pressurize the system after an emergency depressurisation event (i.e. a protection system is implemented).
- Full assessment of material, stress analysis, design and fabrication quality.

5.2 Design Pressure

{Rule 10:

The following requirements shall apply to process components and piping:

- All pressures to be given:
 - at the selected pressure reading (gauge or absolute),
 - at the top of the vessels,
- The equipment elevation relative to the reference level to be indicated on the P&ID.
- The liquid density and the maximum liquid height to be specified on the Process data sheet.}

5.2.1 Maximum design pressure

{Rule 11:

The following general requirement shall be applied excluding storage tanks:

- The maximum design pressure of process equipment to be greater or equal to the values specified in Table 1 and Table 2.
- For columns, same design pressure to be selected for the top of the tower and its associated condenser, reflux drum and inter connecting piping.
- The design pressure of a system connected to a relief network (flare or vent) not less than the relief system design pressure.
- Hydraulic pressure due to the relative elevation between pieces of equipment, and also the pressure relieving device (PRD) location to be considered.
- The minimum set pressure interval between successive layers of overpressure protection (PAH, PSHH, PSV and/or HIPS) to be 0.5 bar.
- If system is fully rated, the maximum design pressure to be higher than the fluid vapour pressure at maximum possible temperature when isolated.}

Design pressure may have to be increased to take into account the transient operating modes (e.g. pigging, shut-down, restart), cyclic operation (e.g. regeneration, backwash), turndown conditions and upsets (e.g. pressure surge due to water hammer, slugging regime, packing) (see [GS EP SAF 262](#)).

General Specification		GS EP ECP 103
Process design criteria		
Rev.: 12	Effective date: 01/2020	Page: 14 of 61

Table 1: Maximum design pressure of equipment with positive operating pressure

normOP (barg)	Maximum design pressure (barg)	
	PSV discharging to atmosphere	PSV discharging to a flare
< 1	2	3.5
$1 \leq \text{normOP} < 2.5$	normOP + 1 bar	
$2.5 \leq \text{normOP} < 10$	normOP + 1 bar	
$10 \leq \text{normOP} < 150$	normOP + 10 %	
≥ 150	normOP + 15 bar	

The margin between normOP and the maximum design pressure may need to be increased above Table 1 minimum values in order to stagger successive layers of overpressure protection (PAH, PSHH, PSV and/or HIPS), or to allow proper PSV reseating based on PSV vendor data.

A method to calculate the water hammer surge pressure is described in Table 25: the sum of this surge pressure and normOP should be checked against the system maximum design pressure and appropriate surge protection implemented if required.

Refer to the applicable code for acceptable pressure excursions beyond the system design pressure. For example, shell and tubes heat exchangers may not be equipped with a PRD on the low pressure side if the overpressure caused by a tube rupture is below the code allowed limit (API STD 521).

Table 2: Maximum design pressure of equipment with positive operating pressure (specific cases)

Equipment/piping location	Criterion	Maximum design pressure
Centrifugal compressor suction		compressor calculated settle-out pressure + 5 %
Centrifugal compressor discharge	normOP $\leq$ 10 barg	normOP + 1 bar
	normOP > 10 barg	normOP + 10 %
Positive displacement compressor discharge	normOP $\leq$ 20 barg	normOP + 2 bar
	normOP > 20 barg	normOP + 10 %
Centrifugal pump discharge		Maximum pump shut-off pressure ^A
Positive displacement pump discharge	normOP $\leq$ 10 barg	normOP + 2 bar
	normOP > 10 barg	normOP + 20 %

^A The maximum shut-off pressure is the discharge pressure of the pump at no flow with the maximum suction pressure (suction drum at design pressure + static head at maximum specific gravity and LAH) and maximum driver speed (in case of variable speed drive).

When the centrifugal pump curve is not yet known, the maximum shut-off pressure should be estimated using the following formula:

$$P_d = P_{smax} + \frac{1.2 \cdot head \cdot d_{max}}{10.2} \quad (1)$$

With:

- P_d Design pressure at pump discharge (barg)
- P_{smax} Design pressure of suction drum + static head at d_{max} and at LAH (barg)
- $head$ Head of the pump at process rated flow rate (m)
- d_{max} Maximum possible specific gravity of pumped liquid

For centrifugal compressors and pumps, the design pressure of the system (i.e. piping and all process components) should be reviewed when the performance curves are issued so that the equipment can operate in their entire normal operating range (i.e. at safe distance from surge and stonewall conditions for compressors).

Pumps and compressors design pressure is provided by Vendors (refer to applicable mechanical General Specification or design code).

5.2.2 Minimum design pressure (vacuum conditions)

{Rule 12:

When a minimum design pressure is specified, the coincident design temperature shall be defined and specified on the equipment datasheet.}

A typical example is a pressure vessel that can undergo a steam-out operation.

{Rule 13:

The following requirements shall apply:

- **For equipment operating under vacuum, the minimum design pressure to be lower or equal to the values specified in Table 3.**
- **Steam containing equipment (other than steam-out operation) to be specified for full vacuum conditions.}**

Table 3: Design pressure of equipment operating under vacuum conditions

normOP (bara)	Lower design Pressure (bara)
≤ 0.35	Full vacuum
$0.35 < \text{normOP} < 0.6$	normOP - 0.1 bar
> 0.6	0.5

Equipment that can face vacuum under abnormal conditions such as:

- Vacuum conditions during start-up, shutdown and/or regeneration purges.
- Normally operated full of liquid but that can be blocked in and cooled down.
- Containing condensable vapour but that can be blocked in and cooled down.

General Specification		GS EP ECP 103
Process design criteria		
Rev.: 12	Effective date: 01/2020	Page: 16 of 61

- Can undergo a vacuum condition through the loss of heat input or external cooling (e.g. deluge).

should be treated on a case by case basis. They may not be designed for full vacuum if protective devices are provided (pressurization gas, low pressure switch and vacuum breaker).

6. Pipelines and risers design parameters

Reference is made to **GS EP PLR 100** for offshore pipeline systems and to **GS EP PLR 104** for onshore pipeline systems.

{Rule 14:

For pipelines and subsea pipeline systems, MOP, MinOP, MOT and MinOT shall take into account all modes and conditions of operation including:

- Turndown
- Slugging
- Packing.
- Pigging.
- Start-up, shut-down and restart.
- Normal preservation sequence (if applicable).
- Depressurisation.
- Cooling/heating of a trapped liquid inventory.
- Atmospheric conditions in a water injection system.}

Even though conditions associated to the pre-commissioning and commissioning (e.g. leak test) are not covered by this General Specification, they should be taken into account for the definition of design conditions.

6.1 Temperature

Temperature trips and alarms are provided on upstream or downstream equipment and piping, refer to **Rule 7**. Pipeline design temperature may have to be modified to accommodate the required protection set points staggering.

6.1.1 Maximum design temperature

Depending on the conditions and the risk of thermal stress, the pipeline mechanical design should be based on either a fixed design temperature or a design temperature profile. It applies to both onshore and offshore pipelines.

{Rule 15:

The thermal calculations shall be done as follows:

a) **For fixed design temperature**

- Maximum design temperature to be higher than:
 - MOT + 15 °C,
 - maximum surface temperature due to solar radiations,

b) **For design temperature profile**

- Flow rate: system design flow rate (i.e. compressor or pump maximum capacity for injection lines).
- Temperature at source and safety margin as specified in Table 4.
- Heat transfer:
 - Lowest heat transfer conditions: warm ambient temperature, very low external convection, minimum overall heat transfer coefficients (both for thermally insulated lines and bare pipes or cooling spools), etc.,
 - For sea lines, burial in the mud line (depth to be determined based on the Best Estimate soil condition defined with Company Geotechnical Specialist for pipe/soil interaction).}

Design temperature should be provided with associated pressure and density, as per GS EP PLR 100 and GS EP PLR 104.

Table 4: Source temperature and margins on pipeline temperature profile

Pipeline type	Source temperature	Margin on calculated temperature profile	Cooling spool
Production and multi-phase	MOT + 15 °C	0 °C	5 °C added on the calculated temperature at the outlet of the cooling spool
Injection and single phase	TSHH if any or MOT	5 °C	

6.1.2 Minimum design temperature

{Rule 16:

The minimum design temperature shall be the lowest between:

- MinOT - 5 °C.
- Minimum ambient temperature.}

MinOT is the lowest temperature reached under the following operating conditions:

- Pipeline depressurisation as specified by the project.

General Specification		GS EP ECP 103
Process design criteria		
Rev.: 12	Effective date: 01/2020	Page: 18 of 61

- Well opening.
- Riser start-up sequence with cold preservation fluid and gas-lift injection (Joule-Thomson effect).

MinOT does not take into account exceptional cases such as hydrate removal operation.

6.2 Pressure

All pressures are given at the selected reference level for the project, as per **GS EP PLR 100** (e.g. MSL).

{Rule 17:

In order for the pipeline engineer to determine the minimum and maximum design pressure, the following information shall be provided:

- Fluid type and properties (minimum and maximum densities).
- MOP.
- The list of all pressurization sources and their associated maximum expected pressure, with no consideration of potential surge pressure.
- The potential pressure increase due to surge.
- PSV or SIS accumulated pressure or the overpressure reached before completion of the shutdown sequence. In case of a full pressure rated system, there is no relieving device and the ultimate pressure corresponds to the maximum design pressure with surge, or WHSIP.
- MinOP.
- The list of all potential low pressure scenarios including, but not limited to depressurisation, cooling of a liquid full system, atmospheric conditions in a water reinjection system.}

Design pressure should be provided with associated temperature and density, as per **GS EP PLR 100** and **GS EP PLR 104**.

Even though conditions associated to the pre-commissioning and commissioning (e.g. leak test) are not covered by this General Specification, they should be considered for the definition of design conditions.

Exceptional scenarios such as the pressurization of a production pipeline or jumper by chemical injection (methanol, inhibitors, etc.) are not expected to occur during normal operation cycles, and therefore are not included in MOP. However, they are taken into account to determine the system maximum design pressure when required by the pipeline design code.

The list of pressurization sources includes, but not limited to, wells (and associated maximum expected WHSIP), compressors, dead oil pumps, water injection pumps, production pumps and chemical injection pumps.

6.3 Pipeline hydraulic sizing

Reference is made to sub-sections 15.1.2 and 15.1.3 for pipeline sizing.

{Rule 18:

For pipeline diameter determination, a margin of 10 % on overall pressure drop (both static and dynamic) shall be applied for pipelines transporting multiphase fluids.}

7. Onshore storage

Reference is made to [GS EP SAF 341](#) for requirements on hydrocarbon storage.

{Rule 19:

The following requirements shall apply :

- No degassing in a storage tank, with the only exceptions of vapour pressure fluctuation with atmospheric environment changes (pressure and/or temperature).
- Degassing boot sized to cover all upset conditions in the upstream process facilities.}

In addition it should always be checked that for all normal operating situations no degassing occurs within neither the degassing boot nor the storage tank.

{Rule 20:

Atmospheric tanks (excluding cryogenic service) shall be designed full of water (or full of product if the product specific gravity > 1) as a minimum.}

Depending on the type of tank, higher design pressures may be required (treated on a case by case basis depending upon tank type). Reference is made to [GS EP PVV 312](#).

8. Floating units

{Rule 21:

The design of process components installed on floating units shall take into account the motion conditions applicable to operation.}

These motion conditions may be different from the motion conditions for the structural design.

9. Material selection

{Rule 22:

Company's corrosion specialists shall always be consulted to make or validate the material selection.}

Reference is made to [GS EP COR 005](#).