



Exploration & Production

GENERAL SPECIFICATION

PIPING VALVES VESSELS

GS PVV 119

Metallic piping support design

02	10/03	General review - Change of Group name and logo
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1. Scope

This specification covers the requirements for the design, fabrication of cryogenic and non-cryogenic pipe supports, including secondary structures fixed to main structures or concrete pipe-racks (see Figure 1).

Cryogenic supports are used on lines handling fluids which the minimum operating range is in the range -196°C to -46°C and able to operate up to +66°C.

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.

Unless otherwise specifically indicated in writing, the supports design shall conform to the requirements of this specification and those of the latest editions at the time of call for tender of the documents listed hereafter, where applicable.

Construction Codes or Government regulations which may be listed in the Project Specifications, in the Requisition or in the Purchase Order, if any, shall have precedence except where this Specification is more stringent.

Any divergence between any of the Contractual Reference Documents or between this specification and any other Contractual Reference Document, should be reported to the COMPANY for decision. In such a case, and unless otherwise agreed or decided by the COMPANY, it is understood that the more stringent requirement shall apply.

Standards

Reference	Title
MSS SP 58	Pipes hangers and supports: materials and design
MSS SP 69	Pipe Hangers
MSS SP 77	Guide Lines for Pipe Support Contractual Relationship
DIN 7707	Resin impregnated and compressed laminated wood and insulating wood. Test methods (part 1) and types (part 2)
BS 3974	Pipe supports

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	



Codes

Reference	Title
ASME B 31.3	Process Piping

Other documents

Reference	Title
49 CFR 193	Liquefied Natural Gas Facilities: Federal Safety Standards
NFPA 59 A	Production Storage and Handling of Liquefied Natural Gas

Total General Specifications

Reference	Title
GS COR 230	External laminated glass fibre/resin based coating for risers of sea-line
GS COR 350	External protection of off-shore and related structures and equipment by painting
GS PVV 107	Flexibility analysis
GS PVV 111	Piping design specification
GS PVV 611	Welding of pressure containing piping and equipment

3. Requirements applicable to all supports

3.1 General

Piping and accessories shall be adequately supported and provided with suitable anchorage to prevent excessive loads on connected equipment, and to prevent undue movements caused either by expansions or by vibrations.

Supports shall be designed so as to meet all static, operating and occasional loads (earthquake, surge, etc.) to which the piping may be subjected. The design shall be based on all concurrently acting loads transmitted into such supports. The concurrently acting loads are those derived from the relevant piping stress analysis of the related line.

For piping containing gas and not subject to an hydrostatic testing, weight of liquid shall not be considered provided that precautions against liquid entrance into the piping have been taken.

Support points shall be adequately located and spaced for optimum load distribution and weight balance.

Guides and direction restraints shall be so as to allow lines to expand and contract freely relative to the anchor, and must be designed to be structurally suitable to withstand loads involved.

Piping entering vessels will preferably be supported from brackets attached to the vessel which shall be designed accordingly.



All support components to be welded on pipes and fittings shall be of the same material as the relevant pipe; welding shall be by qualified welders in accordance with qualified procedures and shall comply with the COMPANY specification **GS PVV 611** for welding.

Supporting one line from another should be avoided as much as possible and is forbidden for cryogenic lines.

Reinforcements to be welded to the pipe during prefabrication shall be shown on isometric drawings and positioned.

Where concrete or steel pipe-rack is not located immediately above the point of support, it will be necessary to provide supplementary secondary steel structures to obtain a point of support. These secondary steel structures shall be designed to cope with main structure design, and provision will be taken to eventually reinforce the main structure (gussets, etc.).

Loads (permanent and temporary) induced by these secondary structures shall be considered in main structure design. Secondary structures shall be painted according to the applicable Project painting specification.

3.2 Selection of proper supports

The method of supporting depends on:

- Pipe movements
- Forces and loads at points of support
- Pipe insulation
- Existing structure.

3.2.1 Pipe movements

At points of support subject to vertical movements, spring supports of suitable design shall be used to prevent excessive load variation. All springs shall be provided with devices preventing misalignment, eccentric loading and excessive spring stresses.

When piping stress is critical, the use of constant load supports shall be imposed.

At points of support subject to horizontal movements, the displacements shall be taken by the use of sliding supports (with adequate length to take into account pipe displacements, etc.) or by the swing of long hanger rods (in any case, maximum angular displacement shall not exceed 5 degrees).

Selected pipe hangers shall be of an adjustable type.

Pipes installed with axial bellows shall be guided from each side in order to maintain correct alignment, and anchors for bellows shall be designed to withstand the pressure thrusts.

Piping installed with cold spring (only applicable for non-cryogenic lines) shall be shown on drawings in the pre-stressed cold position. Clearances shall be kept free for both construction and hot conditions.

Except otherwise stated, construction allowances shall be ± 2 mm.

3.2.2 Forces, loads and moments

For each support, the Contractor shall define a combination of loads and moments respectively for permanent loads and occasional loads not exceeding the allowable stresses of support components.

Other combinations of loads and moments shall be checked with the support design by the Contractor.

3.2.3 Allowable stresses

Allowable stresses for materials commonly used in the design of pipe hangers and supports are listed in Tables 2 and A1 of [MSS SP 58](#).

Allowable stresses for materials not listed in Tables 2 and A1 of [MSS SP 58](#), with known physical properties shall be determined as the lower of the following values:

- 1/4 of minimum tensile strength at service temperature
- 5/8 of minimum yield strength at service temperature.

Allowable stresses for castings shall be multiplied by a casting quality factor of 0.8.

3.2.4 Pipe insulation

Weather jacketing on insulated piping and specially vapour barrier on cryogenic pipes shall be protected from damage at all support points. On hot insulated lines for personnel protection, the insulation may be interrupted.

Pipe clamps of hanger assemblies shall have their rod attachment outside the insulation.

4. Cryogenic supports

4.1 Forces, loads and moments

Allowable forces, loads and moments combination shall be defined in accordance with paragraph 3.2.2, for support components (plates, welds, etc.). Insulation cradles shall be high density foam design with a minimum safety factor of 5.

4.2 Design

Cryogenic supports shall be designed to minimise thermal conduction which could adversely affect the fluid in the pipe and/or the surrounding structure.

Cryogenic supports shall be designed taking into account warm-up and cool-down conditions. Adequate systems shall be used in order not to induce additional stresses on insulation material.

Clamps will be installed around insulation. Tolerances on clamps shall be compatible with insulation cradle tolerances to have the maximum contact between clamp and insulation for the best distribution of loads.

Clearances between upper and bottom part of clamps shall be sufficient taking into account warm-up/cool-down procedures and erection tolerances.

For cryogenic anchor supports, trunnions design shall be preferred. Trunnions shall be of sufficient length to allow a minimum of 300 mm of bare metal between termination of insulation and support/structure.

Legs on trunnions to be welded to the product line shall be of the same material as the line.

In order to reinforce the trunnion, gussets shall be used and shall be welded to the pipe or to the base-plate.

Cryogenic anchor supports shall be adequately designed taking into account the following, where applicable:

- Resultant forces and moments
- Stress level in the weld between anchor and pipe
- Stress level in the anchor
- Rigidity of the anchor foundation
- Strength of the anchor foundation
- Strength of the load bearing insulation.

Differential movements between a pipe component and its welded-on anchor can produce high stresses in the pipe, leading to wall damage or failure (buckling).

For thin wall pipes, reinforcing saddles (where required) shall be avoided and shall be replaced with higher pipe schedule/thickness.

Supports designed with wooden blocks (as stops, etc.) shall have a good finish of its insulation. If the wooden block is outside the insulation, it shall be covered by a weather resistant mastic.

Wooden blocks shall be designed in accordance with [DIN 7707](#).

For clamp fastening on insulation cradles, a bolt tensioning torque procedure shall be defined by the Contractor for pre and after cool-down and submitted to the engineer prior to any use.

At support location, insulation material shall be reinforced as follows:

- High density foam for resting and guide (160 kg/m³ or higher)
- Wooden blocks for stops.

A maximum deflection of 1% on insulation cradle shall be respected.

4.3 Welds

All welds shall be 100% radiographed (x-rays) or checked by calculation.

Allowable stresses in full penetration welds shall be same as for the plate material.

Allowable stresses in fillet welds shall be the allowable stress for the plate material multiplied by a joint factor of 0.8.

For fillet welds, the design throat thickness shall not be less than 0.7 nor greater than 0.8 times the leg length (for definition, see [BS 3974](#)).

5. Non-cryogenic piping supports

Supports for lines NPS 1½ and smaller shall be designed by the Contractor.

Non-insulated lines <12" will rest directly on the support member.

For piping in marine atmosphere polymeric (polyethylene, polypropylene or PTFE) sheath or sheet shall be inserted between piping and support to avoid corrosion built-up.

Hanger rods for lines subject to thermal displacement should be set out of plumb to an amount equal to one-half of the anticipated displacement of the pipe at the point of support.

On galvanised carbon steel pipes, a rubber sheet shall be placed between the clamp and the pipe.

6. PTFE sliding plates

The following lines shall be supported with special PTFE sliding plates in order to minimise horizontal forces caused by frictional resistance:

- All cryogenic lines
- All process lines NPS > 12"
- All cold insulated lines NPS > 3", when support clamps are tightened around insulation cradles.

PTFE sliding plates must be purchased from an experienced Manufacturer who can prove successful operation during five years minimum of devices supplied by him and fabricated according to the same procedure.

PTFE sliding plates shall be prefabricated and shall be embedded in steel substrate.

The best design shall be selected taking into account the actual working conditions, with the following particular emphasis:

- PTFE sliding on PTFE, or on stainless steel (polished), depending on vertical loads and on allowable axial friction loads
- With an insert in neoprene or not, depending on parallelism of surfaces
- The PTFE area shall be selected based on vertical loads and on maximum allowable contact pressure.

7. Supports for corrosion resistant alloy (CRA) piping

Following rules shall be implemented to protect piping made of CRA (AISI 316L, 317, 321, austenitic-ferritic stainless steel, Inconel ...), from potential risk of crevice corrosion at clamps, supporting devices or contact areas.

Protection shall be applied to the pipe itself at the location of the support, even if the support is already painted.

The following solutions are acceptable:

- Pipe is coated with a vinyl-ester paint reinforced with glass flakes. The coating shall be applied in accordance with **GS COR 350**.
- CRA doubler plate is welded to the pipe (100% welding, the welding gas vent to be plugged) followed by a passivation treatment.
- Stratified shell composed of laminated epoxy resin reinforced with fibreglass is glued to the pipe as specified in **GS COR 230** (§ Application of the coating on site).

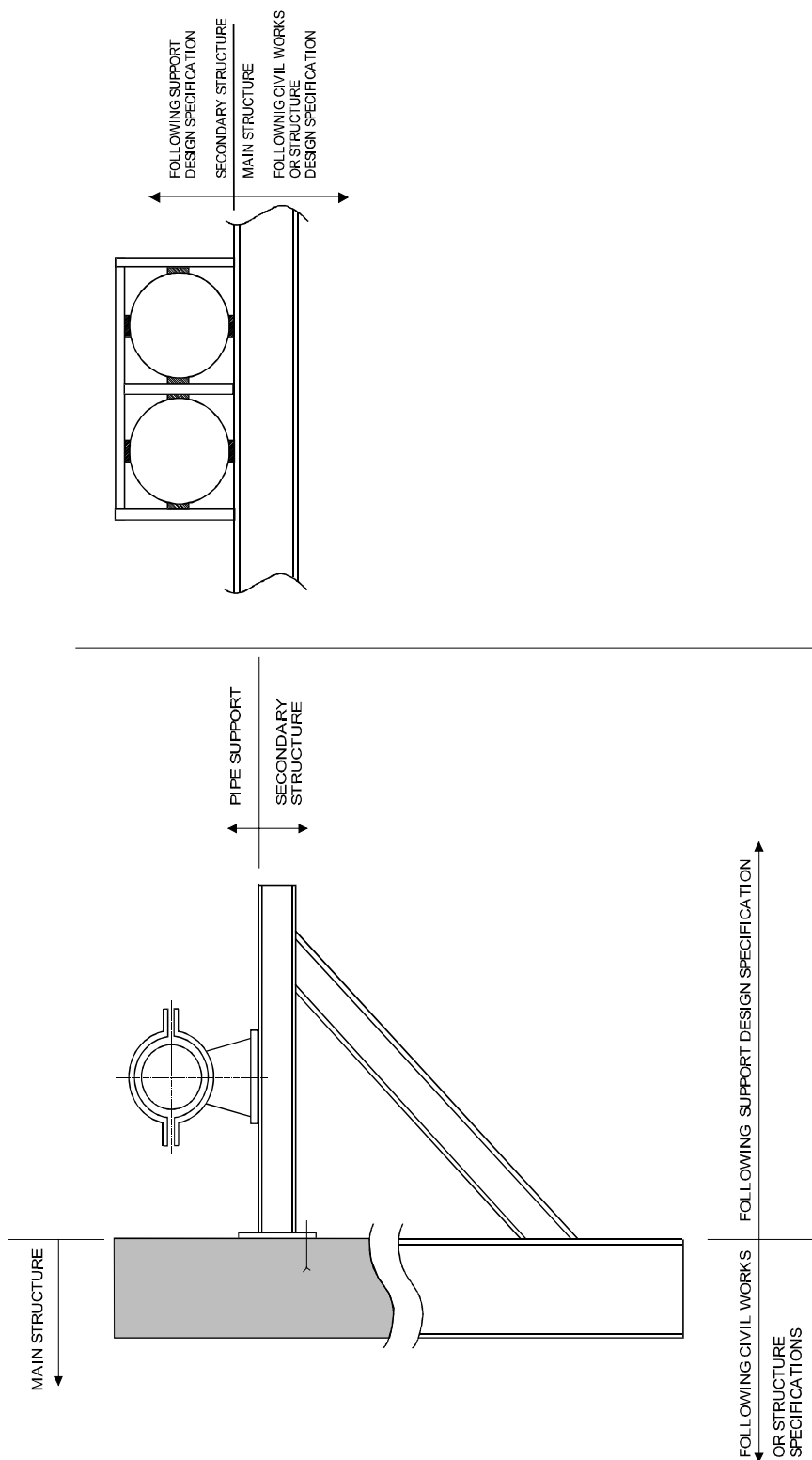


Figure 1 - Secondary steelwork structures