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Review Article

Special consideration for Material Requisition of Engineered Pipe Support

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Abstract

Intent of this paper is to understand the special considerations for Engineered pipe supports like Spring Hangers, Rigid Strut, Dynamic Snubber etc. during different phases of a project. This document covers the key points and minimum requirements for the engineering, design, manufacturing, inspection, testing, preservation, preparation for shipment & packing and supply of goods for engineered pipe supports.

Keywords: *Engineered Supports, Spring Hangers, Rigid Struts, Dynamic Snubbers etc.*

1. Introduction

In an oil & gas project, various piping support combinations are used to control forces & moments, stresses & displacements etc. in a piping system. These supports are procured as bulk and specially designed through material requisition. For the design and arrangement of support components, optimum coverage of the specific support function is the decisive factor. It is the responsibility of the engineer to consider key considerations while preparing the MR so that at later stage there will not be any friction between the vendor and the contractor.

This paper enlightens the special considerations while preparing Material Requisition for Engineered pipe supports.

2. Engineered Supports

Pipe supports are an integral part of any piping system. Selection of accurate pipe support configuration is crucial for the appropriate behavior of the system. Pipe support can be used in various configurations such as standalone or in combination, to control different parameters like displacements, forces, moments, stresses, sagging etc. Appropriate & economically viable selection and engineering of pipe support is a task that needs to be taken care of during all phases of design and execution of a project. The complex requirements for modern pipe supports are:

- Maintenance-free operation
- Quick delivery
- Easy installation
- Reliable functioning

Piping supports are primarily divided into two categories:

- Standard Supports
- Engineered Supports

Standard supports are those which are used very frequently & have a common design, generally available in the project piping support standard.

Engineered supports are those special supports which are designed according to the requirements in the piping problem. The design to these supports is unique, location and condition specific. Different types of engineered supports are Spring hangers, Rigid struts, Dynamic snubbers, Sway Brace, Expansion bellows etc.

In this paper we will elaborate the key points that a responsible engineer should take care of while preparing Material Requisition to avoid any late changes resulting into Change Order which in turn has a cost impact.

Furthermore, these points will help the vendor have a clear and precise picture of what the customer requirement is.

3. Key considerations in various Engineered Supports

3.1 Spring Hangers

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3.1.1 Design

Spring supports/ hangers design and materials shall be as per manufacturer's standards but shall comply with the requirements of datasheet and specification supplied to vendor. Deviations other than those acceptable by this specification shall be reported to the purchaser.

3.1.2 Material

3.1.2.1 Spring assemblies shall be supplied as per Manufacturers Standard and shall be suitable for an ambient temperature range of 0 deg C to (+) 46 deg C.

3.1.2.2 All applicable materials shall be PMI (Positive material identification) tested.

3.1.2.3 All contact areas shall be designed / arranged so that there is no electrolytic or galvanic action.

3.1.2.4 All clamp halves shall be formed from continuous plate.

3.1.2.5 The maximum deviation from the spring constant rate of change for variable spring hangers, as published in the supplier's catalogue, shall not exceed 25% on either the heavy or the light side, except when noted on the specification drawing.

3.1.2.6 Constant spring hangers must have a field load adjustment of at least +/-10% on either side of the operating hot load setting.

3.1.2.7 Hanger assemblies shall be capable of Maximum 4-degree vertical deflection between the pivot points with no appreciable effect on the operation of the spring.

3.1.2.8 Both variable and constant spring hangers shall be calibrated, tested, and pre-set so that the marked operating load is within 6% of the load shown on the hanger drawing after the prescribed movement.

3.1.2.9 Base mounted springs shall have a PTFE / Bronze/Graphite Slide Plated load flange depending on the line temperature.

3.1.2.10 Lifting lugs shall be supplied for each spring hanger assembly weighing over 15 kg.

3.1.2.11 Components must be compatible for assembly and erection without field modifications.

3.1.2.12 Fabrication and installation dimensions shall be in accordance with the drawing and specification sheets.

3.1.3 Design Conditions

3.1.3.1 The spring hanger loads given on the data sheets do not include the weights of spring housing, rods, clamps etc. The Supplier shall adjust calculated loads to accommodate this additional weight. The new calculated weight shall be included on the supplier's bill of materials.

3.1.3.2 Variable Springs shall have a maximum variation between installed load and operating load of 25% UNO.

3.1.3.3 Spring hanger assemblies shall be designed for the operating condition. They shall also be designed to withstand any design loads or movements and to support the hydro test weight. If the hydro tests weight is not stated it shall be assumed to be minimum 2 times of operating weight.

3.1.3.4 Each spring support assembly shall be suitable to sustain the hydro-test load as given on the specification drawing. In case the spring housing or components of an assembly are not capable to sustain the required hydro-test load, purchaser shall receive formal notification. When accepted by purchaser, this spring support/hanger assembly shall be permanently tagged: “Remove this assembly during Hydro-test and provide a temporary support to take care of hydro-test load.”

3.1.4 Travel Stops

3.1.4.1 Each Spring Hanger Assembly shall be provided with travel stops to restrict both upward and downward movement however, the stops shall not restrict the adjustment of the spring assembly while the stops are in place.

3.1.4.2 The stops shall have a red warning tag that shall have a note indicating when the stops are to be removed

3.1.4.3. Where bands are used to retain travel stops, the band shall be made of steel and located in a position that does not obscure the load markings.

3.1.4.4 Travel stop shall be provided to restrict any upward movement during pipe empty
condition. A warning label “Block against empty conditions “shall be placed.

3.1.4.5 Travel stop shall remain in position until hydro, testing has been completed, water removed from the system and line has been filled with actual service liquid.

3.1.4.6 When the travel stops are not in use, they shall be securely linked to the spring housing so that they cannot be easily discarded. Attachment must be designed so that the stops are retrievable for future use. Securing stops with wire is not normally permitted.

3.1.5 Welding/Painting /Galvanizing

3.1.5.1 Welding, painting, and galvanizing shall be in accordance with project specification "Surface Preparation & Painting" or Manufacturer's standard. In case of conflict the more restrictive shall apply and the manufacturers standard shall be issued for approval with the bid.

3.1.5.2 Galvanized spring hanger housings shall not be welded after the coil has been installed. Retainers for the coil shall be a bolted or spilt ring type construction to avoid burning of the housing.

3.1.5.3 Spring coils will be plastic coated or powdered coated.

3.1.6 Beam Deflection

Beams supplied by the manufacturer in spring hanger assemblies (Trapeze type etc.) shall be designed so that there is a maximum of 2mm deflection for the maximum load indicated on the specification drawing.

3.1.7 Material Test Reports

3.1.7.1 For all material specific to ASME (SA) specification in the item description, Supplier shall furnish the Manufacturer's MTRs showing actual results of chemical analysis and mechanical tests in compliance with the referenced ASME specification. The test reports shall be traceable to each item through legible paint stenciled heat numbers or equivalent. The documents shall be identified with XXX's PO number and item Code number and shall be signed by the Manufacturer's authorized agent.

3.1.7.2 All products to be delivered shall be certified with material and finished product certificates as per EN 10204 Type 3.1. Relevant test reports shall also be furnished along with material certificates.

3.1.8 Identification

Each assembly shall be packaged as a unit and identified with its own tag assembly number as shown on its specification drawing and/or fabrication and installation drawing.

3.1.9 Tagging

3.1.9.1 All tags to be in English/or preferred language of the project location. Spring hangers shall have a corrosion resistant metallic nameplate tag having a minimum thickness of 28 gauge permanently attached to the spring housing by means of 4 stainless steel fasteners.

3.1.9.2 All lettering shall be a minimum 4.5mm high in a color to contrast the tag. This tag shall contain but not be limited to the following data: -

3.1.9.2.1 Spring assembly number.

3.1.9.2.2 Spring scale including load versus deflection KN/mm at 10mm intervals.

3.1.9.2.3 Operating load setting clearly marked by a raised element such as a rivet painted red.

3.1.9.2.4 Installed load setting clearly marked by a raised element such as a rivet painted white.

3.1.9.2.5 Spring type size and serial number.

3.1.9.2.6 Manufacturer's name and address.

3.1.9.2.7 Manufacturing date.

3.1.9.2.8 Purchase order number.

This can be changed as per Vendor specified tagging philosophy in consultation with responsible engineer

3.1.10 Installation

3.1.10.1 Travel Stop removal

Travel stops shall remain in position until hydro testing has been completed and water removed from the system. Some liquid lines (including all lines > DN200 connected to storage tanks) shall require the pipe to be filled with the actual service medium before removing the travel stop. If this is required, it shall be noted on the data sheets and on the tag3.1.10.2 Travel Stop removal for lines > DN200 connected to storage tanks.

Travel stops shall remain in position until hydro testing has been completed; water removed from the system and the line has been filled with the actual service liquid. The liquid level in the tank shall be at a minimum level to prevent tank bulge. Due to the large difference between full and empty pipe weights the springs shall have limit stops to prevent any upward movement.

3.1.10.3 Load Adjustment

After removal of the travel stops, the springs may require adjusting to achieve a balanced piping system. The maximum allowable load adjustments are:

Constant spring hanger's variability to be not more than 6% throughout the travel scale.

Variable spring may be altered by any amount provided that 1.5 times the required movement is still possible.

3.1.11 Documentation

Vendor shall supply detailed specification sheets, engineered drawings and calculations, fabrication and

installation dimensions shown in mm. Minimum requirements for information on the specification sheet and drawings to be as follows:

3.1.11.1 Tag Number

3.1.11.2 Dimensions

3.1.11.3 Design and Operating Temperatures and Pressures

3.1.11.4 Test Conditions (fluid medium and pressure)

3.1.11.5 Service

3.1.11.6 Materials of construction / Certificates

3.1.11.7 Special instructions and installation instructions.

3.1.11.8 Production schedule

3.1.11.9 Vendor shall furnish a production schedule indicating material allocated for this project and estimated fabrication / shipping progress for each assembly

3.1.11.10 Material Certificates

3.1.11.11 Vendor shall supply certificates of material compliance for each material shipment, stating that each item listed and included in that shipment confirms to the material specifications denoted on the bill of materials or specifications and/or fabrication and installation drawings.

3.1.11.12 Testing Certificates

3.2 Rigid Struts & Dynamic Snubbers

3.2.1 Design

Rigid Strut, Dynamic Snubber or Sway brace shall be as per manufacturer's standards but shall comply with the requirements of Datasheet and specification herein. Deviations, other than those acceptable by this specification shall be reported to purchaser.

3.2.2 Materials

Selection of materials and their allowable stresses for the support elements shall be governed by Maximum Design parameters of the line and applicable datasheet. Further Rigid Strut and dynamic Snubber assemblies shall be suitable for an ambient temperature range of 0 deg C to (+) 46 deg C unless noted otherwise.

3.2.2.1 All contact areas shall be designed or arranged so that there is no electrolysis or galvanic action

3.2.2.2 All clamp halves shall be formed from continuous plate.

3.2.2.3 Load carrying rods shall be of the welded eye or welded eye lug rod type.

3.2.2.4 Shear carrying pins shall be provided with cotter pins instead of threaded bolts with nuts.

3.2.2.5 Exposed corners and edges shall be ground smooth.

3.2.3 General Details

3.2.3.1 Snubber, Strut and Sway Braces

3.2.3.1.1 Shall be designed to withstand specified loading without buckling

3.2.3.1.2 Shall be designed with a spherical bearing to provide an angular rotation of +/-90° in one plane and +/-5° in the other plane.

3.2.3.1.3 Shall have overall length adjustment of +/-75mm (struts) and +/-40mm (snubbers).

3.2.3.1.4 Shall be furnished so that installation can be done in any spatial orientation without any special devices or arrangements being required.

3.2.3.2 Dynamic snubbers additionally

3.2.3.2.1 Shall be capable to operate in a frequency range 3Hz to 33Hz

3.2.3.2.2 Shall have Travel scale that can be easily readable

3.2.3.2.3 Shall have Oil level gauge with easily readable calibration. Low oil level shall be easily detectable and Oil reservoir to be integral as part of the snubber assembly.

3.2.3.2.4 Shall be provided with welding current protection for 200A in accordance with Vendor's recommendation

Specification schedules do not include weights of clamps, housings or connecting beams in the design loads shown. Manufacturer shall adjust calculated loads to accommodate this additional weight and new calculated loads indicated on vendor's drawings / bills of material

3.2.4 Material Test Reports

For all material specific to an ASME (SA) specification in the Item Description, Supplier shall furnish the Manufacturer's MTRs showing actual results of chemical analysis and mechanical tests in compliance with the referenced ASME specification. The test

reports shall be traceable to each item through legible paint stenciled heat numbers or equivalent. The documents shall be identified with XXX's PO number and Item Code number and shall be signed by the Manufacturer's authorized agent.

All products to be delivered shall be certified with material and finished product certificates as per EN 10204 Type 3.1. Relevant test reports shall also be furnished along with material certificates.

3.2.5 Welding / Painting / Galvanizing

Welding, Painting, Galvanizing, and coating for engineered pipe supports shall be in accordance with specification for welding, surface preparation and protective coating.

3.2.6 Identification

Each assembly shall be packaged as a unit and identified with its own tag assembly number as shown on its specification drawing and/or fabrication and installation drawing.

3.2.7 Testing of Snubber

Qualification testing shall be performed on a sample number of snubber units to demonstrate compliance with the design requirement. The following qualification test should be performed

3.2.7.1 Friction or breakaway test to demonstrate resistance to motion.

3.2.7.2 Release rate based on design or operating condition load, after lock up

3.2.7.3 Velocity or acceleration activation level as applicable

3.2.7.4 Dynamic characteristics test at design condition load.

3.2.7.5 Abnormal environmental transient tests to determine the effects of temperature, pressure, and humidity. Test for the effects of salt spray, and other airborne particles shall be performed when required.

3.2.7.6 Static test to verify manufacture's established faulted condition load capacity

Previous qualification test results on identical equipment shall be considered as acceptable, provided the results meet or exceed the requirements. Qualification test procedure shall be made available if requested

3.2.8 Performance Testing

Each unit shall be subjected to a performance test to verify the following

3.2.8.1 Full stroke and freedom of motion

3.2.8.2 Velocity or acceleration activation level as specified

3.2.8.3 Release rate based on design or operating condition, after activation (Hydraulic Only)

3.2.8.4 Fluid pressure integrity (Hydraulic Only)
Performance test procedures and results should be recorded and available for review

3.2.9 Tagging

All tags to be in English. Rigid Struts and Dynamics snubbers shall have a corrosion resistant metallic nameplate tag having a minimum thickness of 28 gauge attached to the housing by means of stainless-steel fasteners. The tag shall contain as a minimum the following data:

3.2.9.1 Tag assembly

3.2.9.2 Design Load

3.2.9.3 Strut or Dynamic Snubber type, size and serial number.

3.2.9.4 Frequency range / Design stroke (Snubbers)

3.2.9.5 Manufacturer's name and address

3.2.9.6 Date of manufacture.

The mentioned data shall be permanently stamped on the nameplate tag.

Conclusions

From this discussion, it is concluded that Engineered pipe supports are critical components for safe and appropriate behavior of a piping system.
Implementing and incorporating the discussed considerations during the Material Requisition preparation can help to significantly reduce rework, cost and to & fro communication and also ease the installation of any required supports.

The cost of engineered products is the accumulated total arising from individual costs of:

- Design & engineering work
- Installation & assembly work
- Project management (processing)
- Use of material (components)

A well-designed pipe support system will ensure support will be workable even in adverse conditions like sudden change in temperature, any momentary occasional load etc. Engineered supports are almost

always critical for the commissioning deadlines and can, through delays in delivery, cause incalculable extra costs.

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