SERRAGE HYDRAULIQUE
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HYDRAULIC BOLTING
VENTE ET LOCATION
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Correct procedure for flange bolting

Installation Procedure

The most common cause of leaky gasket joints is improper installation procedures. Care shall be taken at all stages given below.

Cutting of Soft Gaskets

First cut / punch bolt holes. Cut the bolt holes slightly larger than the bolts, to ensure proper seating. Never cut out a gasket by hammering material against the flange. Use a good cutter to cut the required shape of the gasket. Ensure that the inside diameter of the gasket is not less than the inside diameter of the process line to minimize obstruction of the process line.

Handling of Gaskets

When working in the field, carry cut gaskets carefully. If you bend the gasket it will be damaged. Always transport large diameter metallic and semi-metallic gaskets to the installation site on its mounting / packing.

Tools Required and Cleaning

Tools will be required to both clean the flange and tension the fasteners.

Clean fasteners with a wire (ideally brass) brush to remove dirt on the threads. After removing old gasket, clean flange surface of all debris using a wire brush (use stainless steel bristles on alloy components) or a brass scraper (a scraper can be made from a sheet of brass, ~5 mm (0.2 in) thick x 50 mm (2 in) wide, which is filed and shaped to a 45° chisel across the width). Using a hammer, lightly tap the scraper into the flange grooves to remove debris.

Flange spreaders may be used to make gap between flanges for cleaning them. Two spreaders are required for a joint. Use mechanical / hydraulic type spreader based on force required to open flanges.

The tensioners will require regular calibration and may include torque wrench, hydraulic or other tensioners. Instruments to measure tension may include a micrometer, or
Ultrasonic equipment.

Visual Inspection

Inspect various components as under.

Fasteners / nuts / washers – after cleaning examine them to assure freedom from defects such as burrs or cracks.
Flange assembly – inspect the flange surfaces for defects, such as radial scores and warping. Ensure that the flange surfaces are sufficiently flat and parallel.
Gasket – check that the correct gasket is available (suitable for the service, size, thickness). Examine the gasket prior to installation to ensure that it is free from defects.

If any defect is observed, replace defective components with a good alternative.

Lubrication

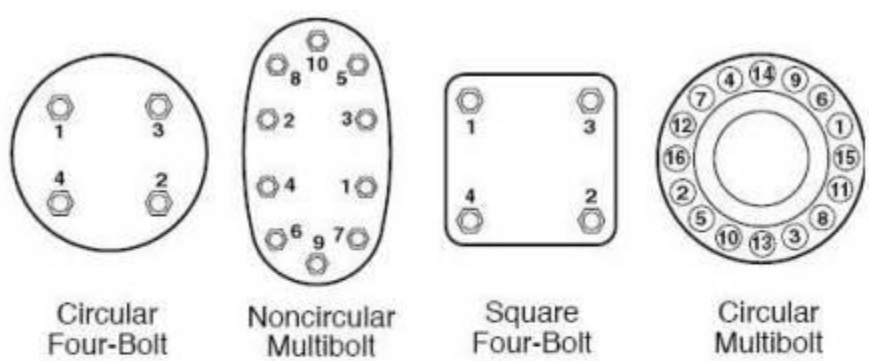
It is estimated that in the absence of a suitable lubricant, up to 50% of the torque effort may be used to merely overcome friction. Effectively, this would mean that the same torque applied to non-lubricated fasteners on a joint might provide markedly different loads on each one. Therefore, lubrication is essential when torque is used as the control for setting tension in the joint. After cleaning, lubricate fastener threads and all bearing surfaces (underside of bolt heads, nuts, washers) with a quality lubricant such as an oil and graphite mixture. Ensure that lubricant does not contaminate either flange or gasket faces.

Gasket Installation

Carefully insert the new gasket between the flanges to prevent damage to the gasket surfaces and center it. Do not use tape to secure the gasket to the flange. If it is necessary to secure the gasket to the flange, use a light dusting of spray adhesive (e.g. 3M type 77). Do not use jointing compounds or release agents on gasket / flange faces.

Bolt / Stud Tightening Pattern

One of the most difficult jobs is to produce the correct assembly pressure on the gasket, low enough to avoid damaging the gasket, but high enough to prevent a leak in the seal. It is vitally important to control accurately the amount of force applied to any particular flange arrangement. Always use a torque wrench or other controlled-tensioning device for tightening. The sequence in which bolts or studs are tightened has a substantial bearing upon the distribution of the assembly pressure on the gasket. Consequently always torque nuts in a cross bolt tightening pattern. Always run the nuts or bolts down by hand. This gives an indication that the threads are satisfactory (if the nuts will not run down by hand, then there is probably some thread defect – check again and, if necessary, replace defective parts). Now torque the joint using a minimum of 5 torquing passes, using a cross-bolting sequence for each pass, as shown below.



Pass 1 – Tighten nuts loosely by hand in the first instance, according to the cross bolt tightening pattern, then hand-tighten evenly.
Pass 2 – Using a torque wrench, torque to a maximum of 30% of the full torque first time around, according to the cross bolt tightening pattern.
Pass 3 – Torque to a maximum of 60% of the full torque, according to the cross bolt tightening pattern.
Pass 4 – Torque to the full torque, according to the cross bolt tightening pattern.
Pass 5 – Final pass at full torque, in a clockwise direction on adjacent fasteners.

After the five basic torquing passes are completed, it may be beneficial to repeat pass 5 until no further rotation of the nut is observed. The final tightening must be uniform, with each bolt pulling the same load.

Hydraulic tensioners are often used to preload fasteners. In this method when the tensioner load is applied, the nut is run down against the joint (finger tight). The hydraulic pressure is then released and the tensioner removed.

Another way to tighten large bolts is to insert a heating rod in a hole drilled down through the centre of the bolt. As it heats up, the bolt expands length wise, and the nut can be run down against the joint (finger tight). The heater is now removed, and as the bolt cools, it shrinks, so developing tension.

Re-tightening

For the majority of materials in the flange system (including gaskets, fasteners, nuts, washers), relaxation sets in after a fairly short time. For soft gasket materials, one of the major factors is usually the creep relaxation of the gasket. These effects are accentuated at elevated temperatures. Due to this the compressive load on the gasket is reduced, increasing the possibility of a leak. Consequently, some engineers recommend that fasteners should be re-tightened (to the rated torque) 24 hours after the initial assembly. Re-tightening shall always be carried out at ambient temperature. *However, this is an area of conflicting views!*

Elastomer-based CAF gasket materials continue to cure in service, especially on start up as the operating temperature is reached. Once fully cured, gasket materials may become embrittled and liable to cracking under excessive load, and this is especially the case with elastomer-based asbestos-free materials. As it is impossible to predict the time for embrittlement, always consult the manufacturer for advice about re-tightening. As a general rule do not re-torque an elastomer-based asbestos-free gasket after it has been exposed to elevated temperatures.

Storage of Gaskets

Although many gasket materials can be used safely after storage for many years, ageing will have a distinct effect on the performance of certain types of gasket materials. Primarily, this is a concern with materials which are bonded with elastomers. They in general should not be used after about 5 years from the date of manufacture. If required, they shall be used only after careful inspection. Materials with elastomeric binders will inevitably deteriorate over time, and even more quickly at higher ambient temperatures. Degradation is also catalysed by intense sunlight. Since graphite and PTFE materials contain no binders, sheets and gaskets of these materials have a virtually indefinite shelf life. In general,

- During storage gaskets should not be subjected to extreme heat or humidity – store in a cool, dry place, away from direct sunlight, water, oil and chemicals.
- Store sheet materials flat.
- Avoid hanging gaskets – they may distort. Store soft gaskets flat. Large diameter spiral wound gaskets should be retained on their mounting board.

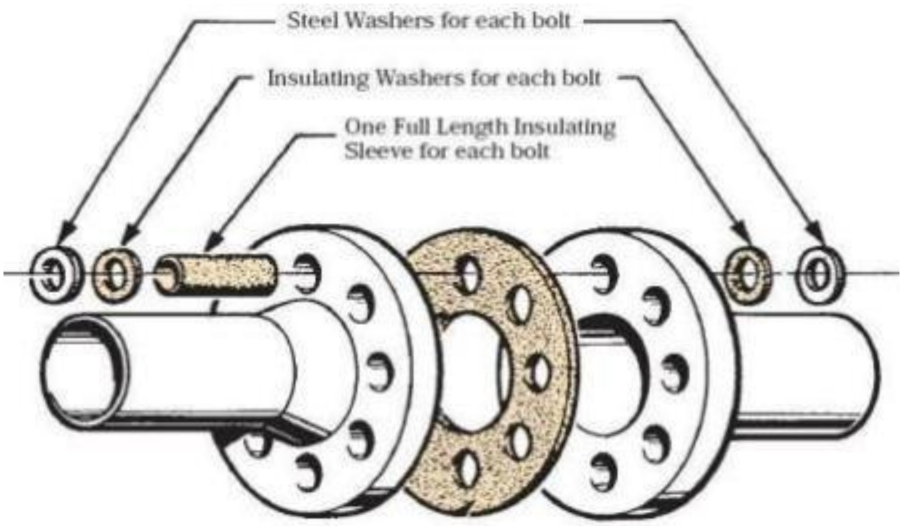
- Gaskets should be kept clean and free from mechanical damage (for maximum protection, store in sealed poly bags).

Useful Information on Joints

In this section other useful information related with a joint is given.

Flange Insulation Sets

Flange insulation sets are installed in pipeline systems to isolate the flow of electrical current. For example – in order to ensure efficient operation of cathodic protection systems for stainless steel pipelines, it is necessary to divide the pipelines into manageable lengths. The installation of flange insulation set at flanged joint ensures effective sealing and isolation from electric current. Different types of sets are available for different types of flanges.



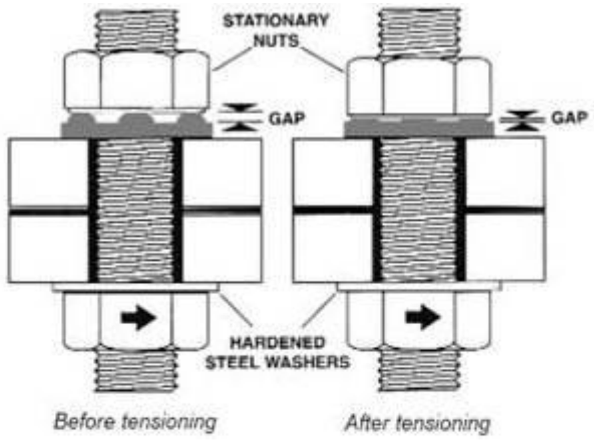
Flange insulation sets comprise the following components which ensure that full electrical isolation is achieved.

- Central insulating gasket which is fitted between the flanges.
- Insulating sleeve per flange bolt.
- Insulating washers per flange bolt.
- Metal backup washers per flange bolt.

The components are manufactured from insulating materials with high compressive strength and good stability

Direct Tension Indicators

Direct tension indicators provide the means to measure bolt tension (bolt load). They are manufactured as per ASTMF959 and F959M. They are generally used with structural fasteners. The Direct Tension Indicator (DTI) is a specially hardened washer with protrusions on one face. The DTI is placed under the bolt head or nut, and the protrusions create a gap. As the bolt is tensioned, the clamping force flattens the protrusions, reducing the gap.



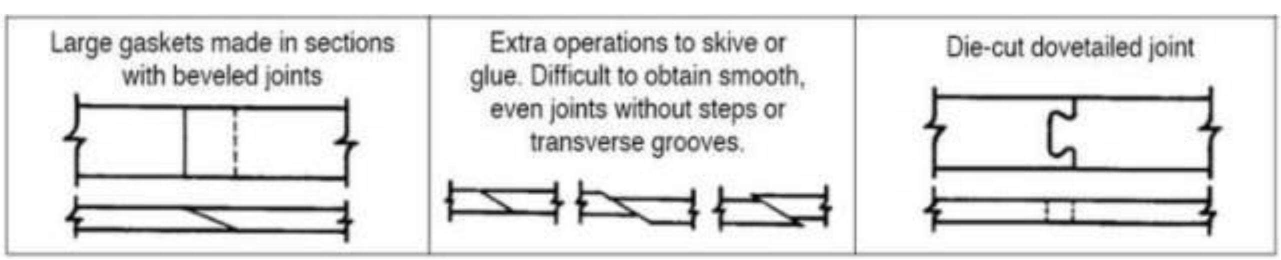
DTI's stay on the job, providing permanent visual and measurable proof that the bolt is correctly tensioned to specification. Gap corresponds to bolt load verified by a test certificate traceable to NIST.

Reuse of a Gasket

A gasket's function is to conform to flange high and low spots when compressed, and its ability to reseal decreases after it is compressed. Gaskets which contain rubber and which have experienced elevated temperatures will be even less likely to reseal. In view of this, it is recommended not to reuse a gasket. Even if the gasket appears to be okay, it is not worthwhile. The cost of a new gasket is minuscule compared to the cost of down time caused by a leak or blowout and the considerations of safety and environmental protection.

Joining of Gasket Sections

For making a large gasket, it is recommended to make a dovetailed joint instead of beveled joint.



Spacers in Flanges

Some installations require a very thick gasket to fill a large gap between flanges. It is recommended not to stack numerous gaskets in the same flange. Tests have shown that a better way to fill a 1/2" gap, for example, is to install a 1/16" gasket on each side of a 3/8" thick incompressible spacer ring. Ideally, the spacer ring shall be consistent with piping metallurgy, serrated, and cut to the same dimensions as the gasket. Higher minimum torque is recommended when using this type of arrangement.

Hydrostatic Testing Precautions

If hydrostatic tests are to be performed at pressures higher than those for which the flange was rated, higher bolt pressures must be applied in order to get a satisfactory seal under the test conditions.

For this, use high-strength alloy bolts (ASTM B 193 Grade B7 is suggested) during the tests. They may be removed upon test completion. Higher stress values required to seat the gasket during hydrostatic tests at higher than flange rated pressures may cause the standard bolts to be stressed beyond their yield points.

Upon completion of hydrostatic testing, relieve all bolt stress by 50% of the allowable stress.

Begin replacing the high-strength alloy bolts (suggested for test conditions) one by one with the standard bolts while maintaining stress on the gasket.

After replacing all the bolts, follow the tightening procedure recommended in the bolting sequence diagrams.

Troubleshooting Leaking Joints

One of the best methods for determining the cause of joint leakage is the careful examination of the gasket where the leakage occurred.

Observation	Possible Remedies
Gasket badly corroded.	Select replacement material with improved corrosion resistance.
Gasket extruded excessively.	Select replacement material with better cold flow properties. Select replacement material with better load capacity – i.e., more dense.
Gasket grossly crushed.	Select replacement material with better load carrying capacity. Provide means to prevent crushing the gasket by use of a stop ring or redesign of flanges.
No apparent gasket compression achieved.	Select softer gasket material. Select thicker gasket material. Reduce gasket area to allow higher unit seating load.
Gasket substantially thinner on OD than ID due to excessive flange rotation or bending.	Provide stiffness to flange by means of back-up rings. Select softer gasket material to lower required seating stresses. Reduce gasket area to lower seating stresses.
Gasket unevenly compressed around circumference.	Make certain proper sequential bolt-up procedures are followed.
Gasket thickness varies periodically around circumference.	Provide reinforcing rings for flanges to better distribute bolt load. Select gasket material with lower seating stress. Provide additional bolts if possible to obtain better load distribution. If flanges are warped, remachine or use softer gasket material

Common Wrong Practices

- Reuse of old gasket (due to non availability of new gasket).
- Procurement of material by generic name with out specification (for example, neoprene sheet).
- Improper storage – Storage of gasket sheets in vertical rolls.
- Cleaning of flanges by chisel / hack saw blades (leading to flange damage).
- Cutting of gasket by hammering against flange / use of chisel instead of sharp cutter.
- Use of many gaskets to fill large gap between flanges.
- Use of one thickness and one type of gasket for all plant application.
- Application of grease on gasket / flange faces.

- Application of tape / thread to hold gasket in position.
- Use of ordinary fasteners instead of high tensile fastener (due to loss / damage to old fasteners).
- Use of dirty / rusted fasteners with out lubrication.
- Improper sequence of bolt tightening.

This from http://practicalmaintenance.net/?p=232#Topic5