De-pressurize the line in compliance with standing instructions.

**AWAYS PROCEED WITH CAUTION!**
Never take it for granted that the line has been de-pressurized. Re-pressurization of the line prior to or during disassembly is possible for many reasons.

REFER TO THE RELEVANT HEALTH AND SAFETY INSTRUCTIONS FOR PROTECTIVE MEASURES.

Start loosening the bolts gradually with steps of maximum 60 degrees rotation in each step in relevant criss-cross pattern.

Continue this pattern until you are able to verify that the seal is broken and the sealring is loose. When you are satisfied that the seal is broken, proceed to loosen bolts further and remove bolts necessary to retrieve sealing.

**FABRICATION - “Respect & Protect”**

1. **Respect sealing surfaces**
   - DO NOT use chains through flange bores or bolt holes.
   - DO NOT allow weld spatter to damage sealing surfaces.
   - DO NOT use earthing clamps on sealing surfaces.
   - TAKE CARE when inserting and removing items through bore.
   - Polish sealing surfaces after heat treatment.

2. **Protect sealing surfaces**
   - Protect seats during and after fabrication.
   - Apply anti-corrosion protection where necessary and re-fit.

3. **Corrosion protection**
   Vector SPO® Compact Flanges and bolts are supplied with various protective coatings. Additional corrosion protection may be required on assembled flanges to suit environmental conditions and/or to rectify coating damage during assembly.
## ASSEMBLY PROCEDURE

### Protection
- Keep the flange protection on as long as possible to avoid damage.
- After examining all sealing surfaces of the Vector SPO® Compact Flange for mechanical damage and rust (step 2), re-apply protection cover before further handling and alignment.

### Verify and inspect components
- Verify that all components are of correct material, type, and size. Size of flange, material and required seal ring type and size are marked on the outside diameter of all loose flanges. On integral flanges on equipment, marking may vary. Make sure the correct size and material of type of sealing is fitted (see Table 1).
- Sealing material is marked as shown. Examine all sealing surfaces for mechanical damage and rust. Run a fingertip over seal surfaces to detect any dents, scratches, gouges, etc.

### Check for seal stand-off
- Perform stand-off check for IX-sealing as follows:
- Place the seal in the groove:
  - If sealing can be rocked slightly: OK
  - If sealing cannot be rocked (contact in groove bottom): REPLACE !
- For stand-off check for HX-type refer to A&D procedure in SPO CF Designer’s Manual.

### Lubrication
- Lubrication of the seal ring groove is not required for coated seal ring. For uncoated seal rings use lubricant in seal groove if torque tools are used, lubricate the stud threads and the nut-bearing interface on the flange on the tool side only.

### Align Hubs
- The flanges are to be aligned prior to seal ring installation such that the stud bolts can easily be inserted into the bolt holes. Approximate misalignment guidance is as follows:
  - Flange diameter < ø300 mm: ± 1.5 mm
  - Flange diameter > ø300 mm: ± 1 mm per ø200 mm

### Insert Seal Ring
- With the lower half of stud bolts in place the flanges can be separated and the seal ring inserted. If washers or spacers are required they should be fitted to the studs that have been inserted. The use of a seal ring installation wire (or equivalent) is recommended. After the sealing has been positioned, the flanges can be carefully brought together until the seal ring is supported by the flange grooves. Hand tighten bolts to prevent flanges from separating and seal ring from dropping out. The seal ring installation wire can now be removed. All the other bolts, nuts and washers can now be inserted. At this stage they should not be tightened more than 10% of the preload or hand tight for the smaller studs.

### Fitting
- Insert the bolts. The stud bolts must protrude 2 threads from the nut at the opposite side where the tool is used. Remove the final misalignment of the flanges by tensioning the bolts starting where the gap is the biggest. (maximum 15% of final preload!)

### Final Preloading
- Personnel shall be skilled and qualified. Bolt preloading procedures must be qualified in tests. Tools and equipment must be the same as in the calibration tests. Please refer to full version of the installation and assembly procedure for details on qualification and calibration. Nuts shall be turned until no further movement is possible on last pre-tension cycle. Gap between the flanges at the wedge shall be fully closed to indicate correct pre-tension. Please consult Table 2 for more information on final bolt tension and torque values.

---

**ASSEMBLY PROCEDURE continued**

**TABLE 2 - FINAL BOLT TENSION AND TORQUE VALUES**

<table>
<thead>
<tr>
<th>Stud Bolt Size</th>
<th>Target Residual Preload (Notes 2 &amp; 4)</th>
<th>Applied Tension, Tension Tool (Notes 2 &amp; 4)</th>
<th>Applied Torque, Torque Tool</th>
<th>μ = 0.10</th>
<th>μ = 0.12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kN</td>
<td>kNm</td>
<td>Nm</td>
<td>kN</td>
<td>kNm</td>
</tr>
<tr>
<td>1/4 UNC</td>
<td>44</td>
<td>265</td>
<td>248</td>
<td>54</td>
<td>86</td>
</tr>
<tr>
<td>5/32 UNC</td>
<td>48</td>
<td>286</td>
<td>268</td>
<td>58</td>
<td>90</td>
</tr>
<tr>
<td>3/32 UNC</td>
<td>55</td>
<td>320</td>
<td>293</td>
<td>63</td>
<td>95</td>
</tr>
<tr>
<td>1/8 UNC</td>
<td>64</td>
<td>384</td>
<td>356</td>
<td>71</td>
<td>103</td>
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<tr>
<td>5/32 UNC</td>
<td>77</td>
<td>456</td>
<td>428</td>
<td>84</td>
<td>126</td>
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<tr>
<td>5/32 UNC</td>
<td>88</td>
<td>520</td>
<td>492</td>
<td>98</td>
<td>140</td>
</tr>
<tr>
<td>1/4 UNC</td>
<td>104</td>
<td>620</td>
<td>592</td>
<td>120</td>
<td>162</td>
</tr>
<tr>
<td>5/32 UNC</td>
<td>113</td>
<td>680</td>
<td>652</td>
<td>133</td>
<td>175</td>
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<tr>
<td>5/32 UNC</td>
<td>122</td>
<td>740</td>
<td>712</td>
<td>145</td>
<td>187</td>
</tr>
<tr>
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<td>800</td>
<td>772</td>
<td>157</td>
<td>200</td>
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<tr>
<td>1/4 UNC</td>
<td>142</td>
<td>860</td>
<td>832</td>
<td>169</td>
<td>212</td>
</tr>
<tr>
<td>5/32 UNC</td>
<td>151</td>
<td>920</td>
<td>892</td>
<td>181</td>
<td>223</td>
</tr>
<tr>
<td>5/32 UNC</td>
<td>160</td>
<td>980</td>
<td>952</td>
<td>193</td>
<td>235</td>
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<tr>
<td>1/4 UNC</td>
<td>170</td>
<td>1040</td>
<td>1012</td>
<td>205</td>
<td>247</td>
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<tr>
<td>1/4 UNC</td>
<td>180</td>
<td>1100</td>
<td>1072</td>
<td>217</td>
<td>259</td>
</tr>
</tbody>
</table>

Notes:
1. Bolting material : A193 B7, B16 and A320 L7
2. Target minimum pre-stress is 75% of yield such that a minimum of 70% is secured taking into account uncertainty in the make-up procedure. Bolt root diameter used.
3. Stress is 95% of yield in bolt.
4. Washers may be necessary for some CL2500 and 5K, 7.5K (formerly CL4500), as well as for Rigid Interface (R) flanges to ensure minimum required bolt length to achieve sufficient residual preload.
5. Values regarding 17M bolts can be found in the assembly section of the Vector SPO® CF designer’s manual.

**TABLE 1 - SEALRING MATERIAL GUIDELINES**

<table>
<thead>
<tr>
<th>FLANGE MATERIAL</th>
<th>Sealing marking</th>
<th>Seal surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade marked on sealring</td>
<td>AISI 4130</td>
<td>AISI 4140</td>
</tr>
<tr>
<td>AISI 4136 (6Mo)</td>
<td>A182 F44 (6Mo)</td>
<td>A182 F51, F53, F55, F61</td>
</tr>
<tr>
<td>ASME 630 (17/4 PH)</td>
<td>A182 F65</td>
<td>Alloy 625</td>
</tr>
<tr>
<td>Alloy 718</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Recommended for cryogenic service below -100°C
2. Not recommended for sour service below -50°C
3. Not recommended for service below -100°C
4. For H25 service refer to NACE MR0175

**Sealing Material Type**

<table>
<thead>
<tr>
<th>Grade marked on sealing</th>
<th>Low Alloy</th>
<th>Stainless</th>
<th>High Strength</th>
<th>Duplex &amp; Superduplex</th>
<th>Nickel Alloy</th>
</tr>
</thead>
<tbody>
<tr>
<td>AISI 4130</td>
<td>AISI 4140</td>
<td>A182 F44 (6Mo)</td>
<td>A182 F65</td>
<td>Alloy 625</td>
<td></td>
</tr>
<tr>
<td>Alloy 718</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Carbon / Low alloy steel
2. Stainless Steel
3. Duplex & Nickel Alloy
4. (recommendations only, does not over-rule client specifications)
5. (1) COLOUR CODING
6. STOP: Avoid this material selection !
7. USE WITH CAUTION: Check specification or seek metallurgical advice (see notes)
8. GD: Good material selection