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Introduction

These are GS-Hydro’s guidelines for the manufacture and assembly of the GS-Hydro 90° flare flange system. In the case of special applications (special sealing arrangements, non-conductive connections, special materials etc) please contact GS-Hydro for further instructions. In order to achieve the integrity required in any piping system it is imperative that operators are fully trained and conversant with the tools and machines to be used. GS Hydro can provide training and instruction as well as installation supervision if required.

The GS 90° flare system is used for class III piping systems with operating pressures of up to 40 bar. Extensive test programs – including rigorous vibration testing – have proven the suitability of the GS 90° flare flange system for a wide range of different materials and applications.

GS Hydro solutions are approved by many Classification companies for a wide range of materials and applications.

Refer to the relevant health and safety instructions for protective measures.

Protect yourself always by using the required personal protective equipments.

<table>
<thead>
<tr>
<th>GS-90° Flare Flange System (technical data):</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SAE</td>
</tr>
<tr>
<td>pressure, bar</td>
<td>40</td>
</tr>
<tr>
<td>size, pipe</td>
<td>16x1.5–220x6</td>
</tr>
<tr>
<td>size, flange</td>
<td>1/2”– 8”</td>
</tr>
<tr>
<td>material, pipe</td>
<td>carbon steel, stainless steel, copper-nickel, duplex, super duplex, titanium (materials having elongation above 20 %)</td>
</tr>
<tr>
<td>material, flange</td>
<td>electric zined carbon steel, hot dip galvanized carbon steel, stainless steel</td>
</tr>
<tr>
<td>material, seal</td>
<td>based on media inside pipe (e.g. Klinger® SIL C-4430)</td>
</tr>
</tbody>
</table>
Selection of the pipe

GS-Hydro recommends the use of cold drawn pipes & tubes due to the inherent quality, (precision dimensions and shape) and cleanliness (no scale) characteristics. As a comparison, hot rolled tubes will always have scale both inside and outside due to the manufacturing process and may not be exactly round.

GS-Hydro's cold forming process ensures there will not be any scale inside the cold drawn tube after the manufacturing.

Original GS-Hydro high-pressure piping can be recognised from the marking GS-PIPING along the tube length.

GS-Hydro maintains a large stock of carbon and stainless steel pipes & tubes to be utilised in hydraulic and other piping systems:

<table>
<thead>
<tr>
<th>Material Specification</th>
<th>Carbon Steel</th>
</tr>
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<tbody>
<tr>
<td>DIN 1630</td>
<td>DIN 2391-1</td>
</tr>
<tr>
<td>EN 10305-4</td>
<td>DIN 2391-2/C</td>
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<tr>
<td>EN 10305-4</td>
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<table>
<thead>
<tr>
<th>Stainless Steel (mm)</th>
<th>Stainless Steel (sch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM A269/A213 (A.W.)</td>
<td>ASTM A312</td>
</tr>
<tr>
<td>ASTM A269</td>
<td>ASTM A530</td>
</tr>
</tbody>
</table>

All precision steel pipes are supplied with trace numbers.

Always keep the tubes stored indoors away from rain and moisture. Make sure all the tubes are fitted with plastic plugs in the ends.
Cutting off the pipe

Cut tubes squarely by using cold saw. Do not use roller cutter or grinder.

After cutting the tube, make sure to put a plastic plug in the tube you do not use.

After cutting, the pipe is de-burred inside and outside; then wiped clean by cloth in order to remove any metal particles.

Especially with small size pipes (below 60 mm) it is also recommended to shoot foam projectiles by means of compressed air through the pipes – use Jet Clean, Compri Tube Clean or a respective method.
Cleaning operations before flaring

Place the GS 90° flare flange on the pipe end with the chamfer facing outwards.

Inspect the flange type before placing it on to the tube. The original GS-flange has a GS-PIPING text, marking of flange type and a charge number for traceability.

Clean the flaring cone and dies before fitting to the flaring machine. Ensure the correct size cone and dies are selected for the tube size.

- Tools must be kept clean and lubricated.
- Tools must be checked regularly.
- Worn-out tools must be replaced.
- Damaged, worn, or dirty tools will affect the sealing efficiency.

Clamping the pipe

Place the pipe between the dies and push it against the stopper. Check that the pipe is positioned horizontally and aligned with the flaring machine. Use pipe supports with long and heavy pipes.
Flaring operations

Use only GS-Hydro flaring machine and genuine flaring cones and clamping dies.

It is recommended to carry out a test flare to find the exact setting of the stopper, the right pressure of the clamping jaws and the flaring pressure as well as the right time setting for the work cycle.

Before beginning the flaring operation check that the surface of the flaring cone has been thoroughly oiled or treated with Gleitmo 830 (Fuchs Lubritech) lubricating paste for cold forming.

After the flaring machine has been set up, the pipe to be flared is pushed into its jaws against the stopper and the jaws are locked (1). Then the pipe is flared (2).

GS-90° flaring is done in two steps – at first with 37° cone...

... and then with 90° cone.

Ensure that the flange is placed on the pipe before beginning flaring operation.

When the flare has formed completely, it should be rolled another 3 to 5 more turns, before the cone is retracted.
Checking the flaring

The flared pipe is cleaned with a cloth before visually checking quality.

Verify the outside dimension of the flaring (Appendix 1–4, pages 11–14) and check that flare is concentric with the pipe.

Check the wall thickness of the flared part. The thickness should be approx. 80% of the nominal thickness of the pipe.

Ensure that the flare is at 90° angle to the pipe.
Assembling of parts

Inspect components prior to assembly:
• Use non-abrasive soft cloth to ensure all components are free from grease, dirt or any contaminants
• Use non-abrasive soft cloth to clean all components from grease and dirt
• Verify that all components are of correct material and size

Verify that you are using the right type and size of bolt. Always use calibrated torque tools. For bolt dimensions exceeding M20 we recommend use of hydraulic torque tool. Please note that there are two values shown for each bolt type, one for Gleitmo 805 (Appendix 5, page 14) and one for MOLYKOTE G-Rapid Plus (Appendix 6, page 15). Torque tables are only valid for these two lubrication agents.

Inspect the bolts and nuts to ensure no damage. Lubricate bolt threads amply according to illustration. Spread evenly with a brush. Tightening must be done from the bolt side. If in special case nut is tightened, then the bolt torque values must be greased with 10%.

Control that pipe ends fit together and are aligned for sealing. Insert the bolts and gasket which will centralize on bolts. Control that the bolts run free through bolt holes, and that the flanges are parallel before starting tightening sequence.
Tighten bolts in diagonal sequence in small increments to appropriate torque level. See illustrated example.
1. Tightening of the bolts should start immediately after greasing of threads
2. Tighten lightly with a wrench.
3. Tighten crosswise with 30% of the recommended torque.
4. Tighten crosswise with 70% of the recommended torque.
5. Tighten crosswise with 100% of the recommended torque.
Repeat this step until all bolts stand still with full torque applied. Minimum 2 full cycles.

We recommend that all bolt torques are checked immediately after pressure test – at least 10% of connections must be verified. We also recommend that after 1 - 2 weeks of system operation, bolt torques of all connections are verified.
During installation

After each tightening sequence ensure that flanges are at 90 degrees to the pipe and that the gap between flanges is equal to \( (x=y) \pm 1 \text{ mm} \).

Also, verify that the bolts protrude 1–2 threads from the nut.

Reassembly

Ensure that all pressure is bled out from the system.

DO NOT take for granted that there is no pressure in the system, all connections must be disassembled with great caution. Please check that all relevant HSE regulations are followed.

Loosen bolts a quarter of a turn in a crosswise pattern similar to assembly. Repeat until all pretension of bolts is released. Continue disassembly until the flange can be moved. Ensure that no pressure is left in the system. Take out the bolts and carefully take the connection apart.

Check all sealing surfaces and ensure no damages. Seal all parts that are not to be reassembled immediately. If temporary storage is required, make sure parts are protected from environmental influences.

We recommend that all soft seals are replaced before reassembly. If the time in operation have been short, and no damage can be seen on the seals, they might be used again.

When the connection is to be assembled again please follow procedure for connecting the joint step by step. Use the correct bolt torque from the tables.
Appendix 1.
Flared joint DIN 90°/St37.4

<table>
<thead>
<tr>
<th>Size</th>
<th>PN</th>
<th>Pipe O.D.</th>
<th>C</th>
<th>C1</th>
<th>d max</th>
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<td>14</td>
<td>73</td>
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<td>22</td>
<td>92</td>
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<td>10–40</td>
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<td>127</td>
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<td>10–16</td>
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Appendix 2.
Flared joint DIN 90°/AISI 316

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<tbody>
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Appendix 3.
Flared joint SAE 90°/St37.4

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<th>d max</th>
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<td>8</td>
<td>9</td>
<td>65.3</td>
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<td>32N</td>
<td>60.3/60</td>
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<td>10</td>
<td>76</td>
</tr>
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<td>40N</td>
<td>76.1/75</td>
<td>8</td>
<td>9</td>
<td>90</td>
</tr>
<tr>
<td>48N</td>
<td>88.9/90</td>
<td>8</td>
<td>10</td>
<td>107</td>
</tr>
<tr>
<td>56N</td>
<td>101.6/100</td>
<td>11</td>
<td>13</td>
<td>123</td>
</tr>
<tr>
<td>64N</td>
<td>114.3/115</td>
<td>10</td>
<td>12</td>
<td>135</td>
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<tr>
<td>80N</td>
<td>139.7/140</td>
<td>11</td>
<td>12</td>
<td>161</td>
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<tr>
<td>96N</td>
<td>168.3/165</td>
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<td>15.5</td>
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<td>28N</td>
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Appendix 4.
Flared joint SAE 90°/AISI 316

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<td>80NSS</td>
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<td>28NSS</td>
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## Appendix 5. Bolt Torques for **Gleitmo 805** -grease

<table>
<thead>
<tr>
<th>SAE 10–40 bar</th>
<th>Bolt DIN 931, 8.8</th>
<th>Bolt torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>Flange Type</td>
<td>Flange to flange</td>
</tr>
<tr>
<td>1 1/2”</td>
<td>124N</td>
<td>M12x70 x40</td>
</tr>
<tr>
<td>2”</td>
<td>132N</td>
<td>M12x70 x40</td>
</tr>
<tr>
<td>2 1/2”</td>
<td>140N</td>
<td>M12x70 x40</td>
</tr>
<tr>
<td>3”</td>
<td>148N</td>
<td>M16x80 x50</td>
</tr>
<tr>
<td>3 1/2”</td>
<td>156N</td>
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</tr>
<tr>
<td>4”</td>
<td>164N</td>
<td>M16x90 x50</td>
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<tr>
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<tr>
<td>6”</td>
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<tr>
<td>8”</td>
<td>228N</td>
<td>M20x120 x70</td>
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</table>

<table>
<thead>
<tr>
<th>DIN 2576 10–40 bar</th>
<th>Bolt DIN 931, 8.8</th>
<th>Bolt torque</th>
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<td>Size</td>
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<td>M16x70 x45</td>
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<td>2 1/2”</td>
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<td>10”</td>
<td>GSEN-PN10-DN350/355.6</td>
<td>M20x100 x65</td>
</tr>
<tr>
<td></td>
<td>GSEN-PN16-DN350/355.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GSEN-PN25-DN350/355.6</td>
<td></td>
</tr>
<tr>
<td>12”</td>
<td>GSEN-PN10-DN400/406.4</td>
<td>M24x110 x70</td>
</tr>
<tr>
<td></td>
<td>GSEN-PN16-DN400/406.4</td>
<td></td>
</tr>
<tr>
<td>16”</td>
<td>GSEN-PN16-DN400/406.4</td>
<td>M27x130 x80</td>
</tr>
</tbody>
</table>

ELZ = Zinc electroplated coating  
HDG = Hot dip galvanised coating  
Torque values are with a tolerance of 0…5%
# Appendix 6. Bolt Torques for MOLYKOTE G-Rapid Plus -grease

<table>
<thead>
<tr>
<th>Size</th>
<th>Flange Type</th>
<th>Flange to flange</th>
<th>Flange to block</th>
<th>ELZ-bolts</th>
<th>HDG-bolts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/2&quot;</td>
<td>124N</td>
<td>M12x70 x40</td>
<td>35 Nm</td>
<td>39 Nm</td>
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</tr>
<tr>
<td>2&quot;</td>
<td>132N</td>
<td>M12x70 x40</td>
<td>35 Nm</td>
<td>39 Nm</td>
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</tr>
<tr>
<td>2 1/2&quot;</td>
<td>140N</td>
<td>M12x70 x40</td>
<td>36 Nm</td>
<td>40 Nm</td>
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<tr>
<td>3&quot;</td>
<td>148N</td>
<td>M16x80 x50</td>
<td>59 Nm</td>
<td>62 Nm</td>
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</tr>
<tr>
<td>3 1/2&quot;</td>
<td>156N</td>
<td>M16x90 x50</td>
<td>77 Nm</td>
<td>80 Nm</td>
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</tr>
<tr>
<td>4&quot;</td>
<td>164N</td>
<td>M16x90 x50</td>
<td>83 Nm</td>
<td>87 Nm</td>
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</tr>
<tr>
<td>5&quot;</td>
<td>180N</td>
<td>M16x110 x60</td>
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<td>108 Nm</td>
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</tr>
<tr>
<td>6&quot;</td>
<td>196N</td>
<td>M16x110 x60</td>
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<td>93 Nm</td>
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</tr>
<tr>
<td>8&quot;</td>
<td>228N</td>
<td>M20x120 x70</td>
<td>104 Nm</td>
<td>109 Nm</td>
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</tr>
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</table>

**DIN 2576 10–40 bar**

<table>
<thead>
<tr>
<th>Size</th>
<th>Flange Type</th>
<th>Flange to flange</th>
<th>Flange to block</th>
<th>ELZ-bolts</th>
<th>HDG-bolts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/4&quot;</td>
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<td>25 Nm</td>
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</tr>
<tr>
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<td>GSEN-PN10/40-DN32/42.4 M16x60 x40</td>
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<td>25 Nm</td>
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</tr>
<tr>
<td>1 1/2&quot;</td>
<td>GSEN-PN10/40-DN40/44.5 M16x70 x45</td>
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<td>31 Nm</td>
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</tr>
<tr>
<td></td>
<td>GSEN-PN10/40-DN40/48.3 M16x70 x45</td>
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<td>43 Nm</td>
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</tr>
<tr>
<td>2&quot;</td>
<td>GSEN-PN10/16-DN50/60.3 M16x70 x45</td>
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<td>28 Nm</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>GSEN-PN10/16-DN50/57 M16x70 x45</td>
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<td>25 Nm</td>
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<td></td>
</tr>
<tr>
<td>2 1/2&quot;</td>
<td>GSEN-PN10/16-DN65/73 M16x70 x45</td>
<td>39 Nm</td>
<td>40 Nm</td>
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<td></td>
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<tr>
<td></td>
<td>GSEN-PN25/40-DN65/73 M16x70 x45</td>
<td>41 Nm</td>
<td>43 Nm</td>
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</tr>
<tr>
<td>3&quot;</td>
<td>GSEN-PN10/16-DN80/88.9 M16x80 x45</td>
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</tr>
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<td>25 Nm</td>
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</tr>
<tr>
<td>4&quot;</td>
<td>GSEN-PN10/16-DN100/114.3 M20x90 x55</td>
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<tr>
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<td>GSEN-PN25/40-DN100/114.3 M20x90 x55</td>
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<tr>
<td>5&quot;</td>
<td>GSEN-PN10/16-DN125/133 M16x80 x45</td>
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<td>6&quot;</td>
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<td>GSEN-PN10/16-DN300/323.9 M20x90 x70</td>
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<td>72 Nm</td>
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</tr>
<tr>
<td>14&quot;</td>
<td>GSEN-PN10/16-DN350/355.6 M20x100 x65</td>
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<td>104 Nm</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>GSEN-PN16-DN350/355.6 M20x100 x65</td>
<td>88 Nm</td>
<td>108 Nm</td>
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<tr>
<td>16&quot;</td>
<td>GSEN-PN10/16-DN400/406.4 M20x120 x75</td>
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<tr>
<td></td>
<td>GSEN-PN16-DN400/406.4 M20x120 x75</td>
<td>104 Nm</td>
<td>106 Nm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

- **ELZ** = Zinc electroplated coating
- **HDG** = Hot dip galvanised coating
- Torque values are with a tolerance of 0...5%
GS-Hydro is the original provider of non-welded piping solutions with numerous benefits for a wide variety of demanding applications. The company operates globally in more than twenty-five countries through own companies and partners. GS-Hydro supplies complete piping systems with engineering, products, prefabrication, services and documentation.