
# HYDRAULIC MAINTENANCE & SAFETY

TIPS TO INCREASE UPTIME & SAVE YOU MONEY

SAFE HYDRAULICS

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# WHY PREVENTIVE MAINTENANCE?

Hydraulic preventive maintenance and safety are important for anyone who operates hydraulically powered equipment. Improperly maintained assemblies can cause premature hose failure and blowouts, resulting in equipment downtime, possible equipment damage, personal injury and even death. Following Safe Hydraulics practices helps to avoid complications.

At Gates, we believe following proper preventive maintenance procedures is time well spent. Shown below are some of the numerous benefits provided by preventive maintenance.

Let's take a look at some preventive maintenance and safety procedures. They'll put you on the right track to safe and long-lasting hydraulic assemblies.

## BENEFITS

- **Reduce downtime**
- **Improve production**
- **Increase efficiency of maintenance personnel**
- **Enhance control of spare parts inventory**
- **Decrease safety hazards and accidents**
- **Extend equipment service life**
- **Reduce capital outlays for new equipment**

# CHOOSING THE RIGHT COMPONENTS

## DON'T MIX & MATCH

Safe, long-lasting hydraulic assemblies begin by choosing the right components. The "right" components are couplings, hoses, crimping equipment and accessories that are all designed to work together. Not all manufacturers offer safe, high-quality components. Mixing and matching couplings from one manufacturer with hoses from another manufacturer can lead to premature or catastrophic assembly failure.

That's because hoses, couplings, assembly equipment and crimping tolerances vary from one manufacturer to another, and they're not interchangeable. When components from different manufacturers are mixed together, coupling retention can be adversely affected. Mixing components can not only cause unnecessary downtime, it can result in personal injury as well. The termination must match as well as the thread or flange ends of couplings must be properly matched to their mating components to create leak-proof connections.

Gates offers a complete line of hoses, couplings, crimpers and related equipment, all designed to work together as a system.

Gates components meet stringent test requirements and are engineered to provide the highest-quality, longest-lasting, safest assemblies available. Your Gates distributor is specially trained to make sure you get the hose assemblies that best meet your needs.

**"HOSE ASSEMBLIES SHALL ONLY BE MANUFACTURED WITH THOSE HOSE FITTINGS WHOSE FUNCTIONALITY HAS BEEN VERIFIED IN ALL TESTS ACCORDING TO THE RELEVANT EN STANDARDS."**

## THE CRITICAL DESIGN FACTOR

Hydraulic system performance is determined by the weakest component, which can be the hose/coupling interface, reassuring that Gates assembly procedures are crucial. Controlling how the coupling is connected to the hose and their interaction is critical to designing effective, reliable and safe hydraulic hose assemblies.

## CHOOSING THE RIGHT HOSE

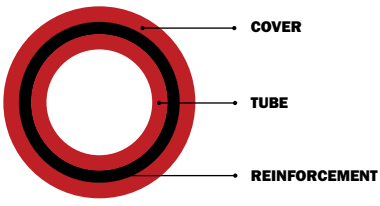
Choosing the right hose is the first step to long and safe assembly service life. But before we look into how to select the proper hose for the job, let's first take a look at the benefits of using rubber hose in fluid power applications. Unlike rigid tubing, rubber hose offers several advantages:

- **Less susceptible to vibration and movement.**
- **Requires no brazing or specialized bending.**
- **Easier to obtain in the aftermarket.**
- **Faster to route around obstacles.**
- **Absorbs sound and impulses.**
- **Dampens pressure surges.**

Given its superior availability and routing advantages, rubber hose is preferred over metal tubing by most maintenance personnel. In fact, it's not uncommon for maintenance technicians to replace metal tubing with a hose assembly.

## HOSE CONSTRUCTION

Hydraulic hoses have three parts: the cover, tube and reinforcement. The cover protects the tube and reinforcing material from environmental conditions like adverse weather, ozone, abrasion, heat, chemicals, etc. Choose a hose with a cover that can meet the demands of your system, especially in abrasive situations or if the hose will be exposed to chemicals or extreme temperatures.



The tube is the part of the hose that comes in contact with the hydraulic fluid. Reinforcement allows the hose to withstand internal pressures, or in the case of suction/vacuum hose, external pressures. Hoses generally have braided, spiraled or helical reinforcement. The type of reinforcement depends on the intended use of the hose.

## THE THREE BASIC TYPES OF REINFORCEMENT ARE:

**Braided reinforcement** can be wire or textile and can have single or multiple layers.

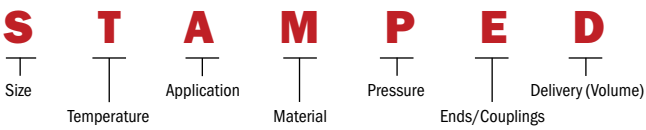
**Spiraled reinforcement** on hydraulic hose is typically wire or textile and has four or six layers (plies). Spiral-reinforced hose can typically handle more severe applications with longer impulse service life.

**Helical coil reinforcement** keeps the hose from collapsing during suction (vacuum) and tight bending.

When choosing a hose, it's crucial that the cover and tube material are all compatible with the type of fluid conveyed in the system or in the surrounding environment. This is an important point to remember because many hoses are not compatible with all of the hydraulic fluids on the market today, including petroleum-based, phosphate ester, water-based and diester fluids.

Other variables, such as elevated temperatures, fluid contamination and fluid concentration, will also affect compatibility. When in doubt, consult the hose manufacturer.

# THE “STAMPED” METHOD




Studies by fluid power manufacturers indicate that the three most common causes of hydraulic hose failure are abuse, misapplication and improper plumbing. Equipment operators and technicians can reduce, if not eliminate, premature hydraulic hose failure by giving maximum consideration to hose assembly selection and installation.

Yet, with all of the different types of hoses on the market, choosing the right one can be difficult.

Gates suggests using the **“STAMPED”** method to ensure you get the right hose assembly for the job. **“STAMPED”** stands for Size, Temperature, Application, Material to be conveyed, Pressure, Ends or Couplings, and Delivery (Volume).

**HERE’S HOW IT WORKS:**

**Size** - Choose a hose with an inside diameter that is adequate to minimize pressure loss and to avoid hose damage caused by the heat generated by excessive fluid turbulence.

**Temperature** - The hose must be able to withstand the system’s minimum and maximum fluid and ambient temperatures.

**Application** - Determine the required industry standard where or how the hose will be used. You’ll need to know the equipment type, working and impulse pressures, fluid to be used, bend radius, static conductivity, etc.

**Material to be conveyed** - The hose, including the hose tube, along with the couplings and O-rings, must be compatible with the type of fluid being conveyed.

**Pressure** - Know the system pressure, including pressure spikes. The hose’s published working pressure must be equal to, or greater than, the normal system pressure and any pressure surges it will encounter.

**Ends or Couplings** - Identify the type of threads the system uses and select couplings that are compatible with those thread types.

**Delivery** (Volume) - How much fluid must go through the hose? This will determine the size of hose that must be used. Undersizing a hose leads to increased pressure loss, turbulent flow and excessive heat buildup. Oversizing the hose adds unnecessary cost, weight and bulk.

## HOSE SIZE (DASH NUMBERS)

| HOSE I.D. (INCHES) NOMINAL INDUSTRY STANDARD DIMENSIONS | | |
|---|---|---|
| **Dash Size** | **Inches** | **DN** |
| -3 | 3/16 | 5 |
| -4 | 1/4 | 6 |
| -5 | 5/16 | 8 |
| -6 | 3/8 | 10 |
| -8 | 1/2 | 12 |
| -10 | 5/8 | 16 |
| -12 | 3/4 | 19 |
| -16 | 1 | 25 |
| -18 | 1.1/8 | 28 |
| -20 | 1.1/4 | 31 |
| -24 | 1.1/2 | 38 |
| -28 | 1.3/14 | 44 |
| -32 | 2 | 51 |
| -36 | 2.1/4 | 57 |
| -40 | 2.1/2 | 63 |
| -48 | 3 | 76 |
| -56 | 3.1/2 | 89 |
| -64 | 4 | 102 |

# AGENCY SPECIFICATIONS

## INDUSTRY AGENCIES

**ABS** - American Bureau of Shipping

**BV** - Bureau Veritas

**DIN** - Deutsche Industrial Norme, German

**DNV** - Det Norske Veritas for North Sea Floating Vessels

**EN** - European Norm/Standard

**ISO** - International Organization for Standardization

**LR** - Lloyd's Register

**SAE** - Society of Automotive Engineers

## GOVERNMENT AGENCIES

**DOT/FMVSS** - U.S. Department of Transportation/Federal Motor Vehicle Safety Standards

**MSHA** - U.S. Mine Safety and Health Administration

**MOD** - Ministery of Defence

# COUPLING IDENTIFICATION

## IDENTIFYING COUPLINGS IS AS EASY AS 1-2-3.

1. **Determine seat type:**
   - Thread
     - Male / Female
     - Type (BSP / JIC / ORFS / DIN...)
     - Conical (Parallel / Taper)
   - 2 - Sealing Surface
     - Thread interface
     - O-ring
     - Mated angle or mechanical joint
     - Mated angle with O-ring
2. **Visually identify**
3. **Measure threads or other dimensions.**

## A HYDRAULIC COUPLING CONSISTS OF TWO FUNCTIONAL ENDS:

1. **The hose end for hose attachment**
2. **The thread end for port attachment**

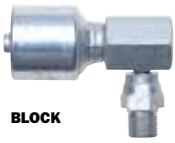

The hose end is identified by the hose size and type to which it is attached. Serration patterns are specified by the coupling manufacturer to meet performance requirements.

The thread end of a coupling (or adapter) can be identified by comparing it with the coupling being replaced or by measuring the port or thread end to which it will be attached. The thread end may also come in different configurations.

STRAIGHT

45°

90°



BLOCK

Hose ends and thread ends are measured by industry standard dash sizes. The hose size refers to the inside diameter in 1/16". The thread size is given by different standards and expressed as dash size.

Tools used for coupling identification include calipers, seat gauges (English and metric), thread gauges, thread ID manuals and thread gauge kits. Gates offers several tool kits that make coupling identification fast and easy.

## COUPLING AND ADAPTER END-STYLE NOMENCLATURE

Gates couplings feature a meaningful description by combining end-style codes shown below that make thread identification fast and easy. Always refer to Gates eCrimp Data Charts when selecting hose and coupling combinations.

The following image shows the Gates 8G8FBSPORX wire braid coupling, a MegaCrimp™ female BSP coupling for -8 (½") hose size with -8 (½") thread size.

**8G8FBSPORX**

- FEMALE BSP 'O' RING SWIVEL
- G 1/2" - 14 BSP
- MEGACRIMP
- 1/2" HOSE ID

# COUPLING - EXPLANATION OF TERMINATION NOMENCLATURE

| PART NUMBER | DESCRIPTION |
|---|---|
| FBSPORX | Female BSP 'O' ring swivel |
| FBSPORX-RB | Female BSP 'O' ring swivel. 60° cone. Rockbreaker version. |
| FBSPPX | Female BSP swivel. 60° cone |
| MBSPP | Male BSP parallel. 60° inverted cone. |
| MBSPP-RB | Male BSP Parallel. 60° inverted cone. Rockbreaker version. |
| MBSPT | Male BSP Taper. |
| MBSPPBKHD | Male BSP parallel. 60° inverted cone (Bulkhead). |
| FBFFX | Female BSP flat face swivel. |
| MBFF | Male BSP flat face. |
| BSPBJ | BSP banjo. |
| FJX | Female JIC swivel. 37° inverted cone. |
| FJISX | Female Japanese swivel. 30° inverted cone. BSP thread. |
| FKX | Female Japanese swivel. 30° inverted cone. Metric thread. |
| MJ | Male JIC parallel. 37° cone. |
| FFORX | Female SAE flat face 'O' ring swivel. |
| MFFOR | Male SAE flat face 'O' ring. |
| MFFORBKHD | Male SAE flat face 'O' ring. Bulkhead. |
| FSX | Female SAE swivel. 45° inverted cone. |
| MS | Male SAE parallel. 45° cone. |
| MIX | Male SAE parallel. 45° inverted cone. |
| MFA | Male SAE parallel. 24° inverted cone. |
| FL | SAE 'O' ring flange. Code 61. |
| FLH | SAE 'O' ring flange high-pressure. Code 62. |
| FLHCFM | SAE 'O' ring flange with pre-installed monobloc. |
| FLC | Caterpillar type 'O' ring flange. |
| FLK | Komatsu type 'O' ring flange. |
| FDLORX | Female DIN 'O' ring swivel. 24° cone. Light series. |

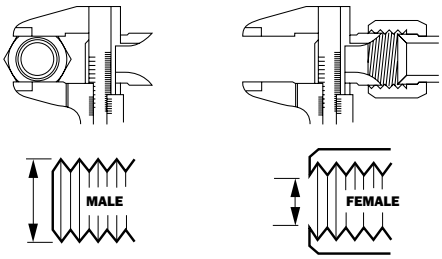
| PART NUMBER | DESCRIPTION |
|---|---|
| MDL | Male DIN parallel. 24° inverted cone. Light series. |
| FDHORX | Female DIN 'O' ring swivel. 24° cone. Heavy series. |
| FDHORX-RB | Female DIN 'O' ring swivel. 24° cone. Heavy series. |
| MDH | Male DIN parallel. 24° inverted cone. Heavy series. |
| FDLX | Female DIN swivel. 24°/60° cone. Light series. |
| FDHX | Female DIN swivel. 24°/60° cone. Heavy series. |
| DBJ | Metric banjo. |
| MSP | Metric standpipe. |
| FPX | Female NPSM pipe swivel. 30° cone. |
| MP | Male NPTF pipe. |
| MPLN | Male NPTF pipe (Long Nose). |
| MPX | Male NPTF pipe swivel. |
| MB | Male SAE 'O' ring boss. |
| MBX | Male SAE 'O' ring boss swivel. |
| FFGX | Female French Gaz swivel. 24° cone. |
| MFG | Male French Gaz parallel. 24° inverted cone. |
| FP | Female NPTF pipe. |
| FPFL | Female French Gaz flange high-pressure. 24° Poclain inverted cone. |
| MPFL | Male French Gaz flange high-pressure. 24° Poclain inverted cone. |
| MKB | Male Kobelco type. |
| HLE | Hose length extender |
| PL | Male Press-Lok. |
| PLSOR | Male Press-Lok Super 'O' ring. |
| AV | Male agricultural valve. |
| FPWXL | Female PressureWash swivel. |
| PWSP | Male PressureWash standpipe with 'O' ring. |
| MQLH | Male Quick-Lok™ High. |
| FQLH | Female Quick-Lok High. |
| MQLD | Male Quick-Lok Direct. |
| MQLL | Male Quick-Lok Low. |

# COUPLING THREAD IDENTIFICATION

Following the steps below will enable you to identify an unknown coupling thread in a short period of time by using the Gates Pocket Thread ID kit.

## STEP 1

Measure diameter of thread, outside of male threads and inside of female threads.

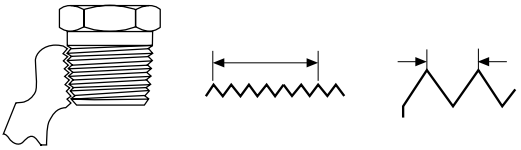



## STEP 2

Refer to the “Thread size identification guide” for details of coupling type and size. The booklet is included in the Gates Pocket Thread ID kit.

## STEP 3

Check the coupling thread. With a thread gauge you can check the number of threads per inch (for imperial couplings) or the pitch of the threads (for metric couplings).



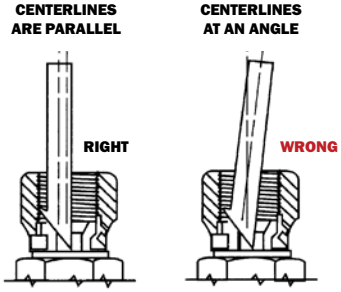
N.B. Coupling thread identification kits containing reference charts, vernier, seat gauges and thread gauges are available. Please ask for details.

## MEASURING SEAT ANGLES

When the centerline of the seat gauge points straight out of the coupling, the angles of the gauge and seat match.

Compare the measurements taken to the coupling specification tables that appear in Gates Fluid Power catalogue (50080) or the specifications in Gates Hydraulic Coupling International Thread Identification Manual.

**NOTE:** Thread binding will occur when different thread configurations are used. DO NOT mix thread configurations.

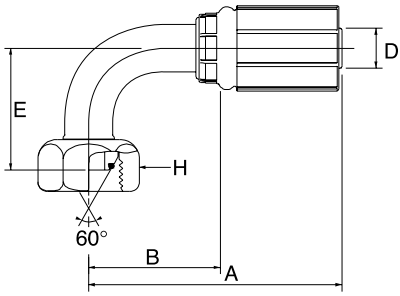


# HOW TO MAKE HOSE ASSEMBLIES OF SPECIFIC LENGTHS

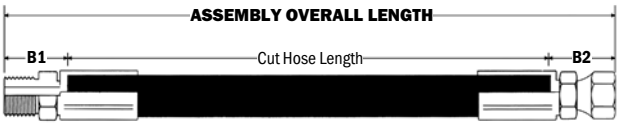
Select the hose and couplings required to make the desired hydraulic assembly. Measure the entire length of the assembly. Then use the formula below to calculate the required hose cut length for the assembly.

Hose Length = Assembly Overall Length Minus (B1 + B2)

Example: Female BSP ‘O’ ring swivel.
60° cone.
90° swept elbow.




Cut-off value “B” is the length of that part of the coupling not directly in contact with or applied to the hose. Therefore, subtract the two “B” values from the total




Hose Length = Assembly Overall Length Minus (B1 +B2)

length of the assembly and you will have the approximate hose length to be replaced.
EN 857 Length Tolerances for Hydraulic Hose Assemblies and Specified Hose Lengths.

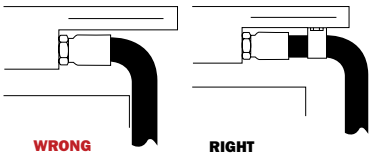
| LENGTH | TOLERANCE |
|---|---|
| From 0 to 630 mm | +7 / -3 mm |
| From 630 to 1250 mm | +12 / -4 mm |
| From 1250 to 2500 mm | +20 / -6 mm |
| From 2500 to 8000 mm | +1.5% / -0.5% |
| From 8000 mm | +3% / -1% |

# HOSE ROUTING

Many assemblies fail because of improper routing. To minimize damage caused by excessive flexing or whipping, all replacement hose should be restrained, protected or guided using clamps. Protective armor, spring guards or sleeves made of abrasion-, temperature- or chemical-resistant material will help protect hose from cuts, abrasions, corrosives or hot components.

Here are some hose routing tips that will prevent unnecessary assembly failures:

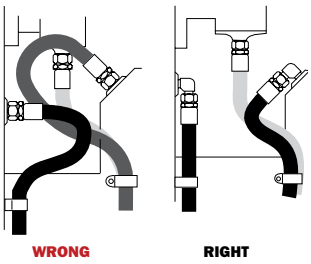
## ABRASION




Run hose in the installation so that it avoids rubbing and abrasion. Often, clamps are required to support long hose runs or to keep hose away from moving parts. Use clamps of the correct size. Too large a clamp allows hose to move inside the clamp and cause wear.

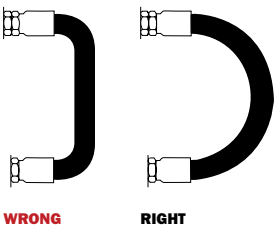
## APPEARANCE

Route hose directly by using 45° and/or 90° adapters and fittings. Avoid excessive hose length to improve appearance.



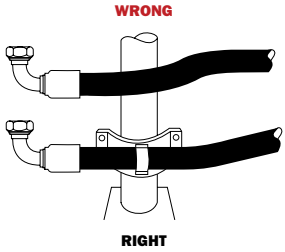

## COLLAPSE

To avoid hose collapse and flow restriction, keep hose bend radius as large as possible. Refer to hose specification tables for minimum bend radius.



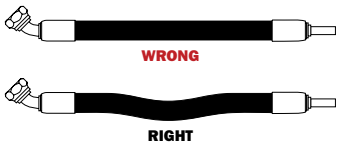
## HIGH HEAT

High ambient temperatures shorten hose life, so make sure hose is kept away from hot parts. If this is not possible, insulate hose with Gates HeatGuard™ protective sleeving.



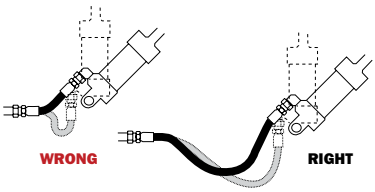

## LENGTH CHANGE

When hose installation is straight, allow enough slack in hose line to provide for length changes that will occur when pressure is applied.



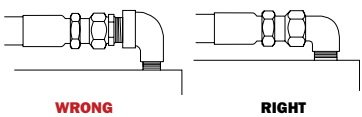

## MOVEMENT/FLEXING

Adequate hose length is necessary to distribute movement on flexing applications and to avoid abrasion.



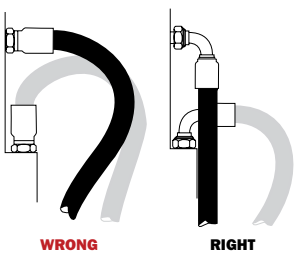

## REDUCE CONNECTIONS

Reduce the number of pipe thread joints by using hydraulic adapters instead of pipe fittings.



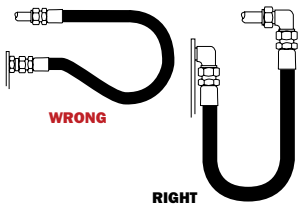

## STRAIN

Elbows and adapters should be used to relieve strain on the assembly, and to provide neater installations which will be more accessible for inspection and maintenance.

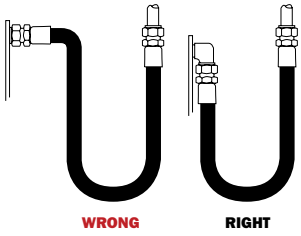


## TIGHT BEND

1. When radius is below the required minimum, use an angle adapter to avoid sharp bends.

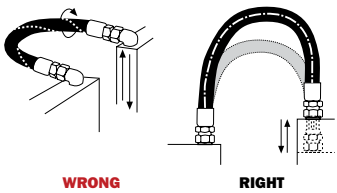



2. Use proper angle adapters to avoid tight bends in hose.

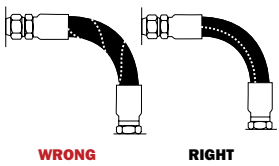



## TWIST

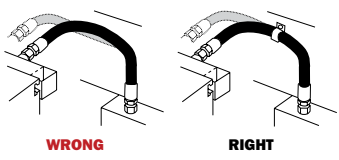
3. Prevent twisting and distortion by bending hose in same plane as the motion of the port to which hose is connected.




4. When installing hose, make sure it is not twisted. Pressure applied to a twisted hose can result in hose failure or loosening of connections.




5. Avoid twisting of hose lines bent in two planes by clamping hose at change of plane.



# HOSE CLEANLINESS

System contaminants can decrease equipment life and cause expensive failures, so it's important to use clean components and assemblies. Cleaning methods vary based on shop capabilities, the cleanliness level required and the critical nature of the equipment.

Perhaps the easiest cleaning method is to simply blow shop air through the hose assembly after it is completed. However, this offers minimal cleaning and is the least effective method.

A fluid-flushing apparatus provides the most effective cleaning method. With this technique, cleaning fluid is flushed at a high velocity through the hose until the hose meets the strictest cleanliness levels.

Pressurized launchers use shop air and projectiles to sweep through the inside of the hose for improved cleanliness. Foam projectiles are blown through the inside surface of the hose, sweeping away fine particles of loose dirt and contaminants. The projectiles are 20–30 percent larger than the hose I.D., and leave a cleaner hose.

# ASSEMBLY INSTALLATION

Be sure to follow these seven steps when installing a hydraulic assembly:

1. Clean the surrounding area where the connection will be made. Do not let dirt or contaminants into the opening.

2. If adapters are used, install them now.

3. Lay the hose assembly into the routing position to verify length and correct routing.

4. Thread one end of the assembly onto the port or adapter. Install angled fitting first to ensure proper positioning.

5. Thread the other end of the assembly, taking care not to twist the hose. Use a wrench on the fitting's backup hex while tightening.

6. Properly torque both ends.

7. Run the hydraulic system under low pressure and inspect for leaks and potentially damaging contact points.

# INSTALLATION TORQUE

Installation torque is important to ensure a proper leak-free seal. Over-torquing of a threaded connection can stretch and damage threads and seat angles. It can also damage the staking area of a nut or possibly break a bolt on the port area. Under-torquing does not allow proper sealing. Torque should always be checked to ensure tightening is within accepted limits. The most reliable method of torquing threaded connections is to first hand-tighten the connection, then use a torque wrench to measure the torque. Torque values vary by thread configuration as follows:

**CAUTION**

Over-torquing may damage nuts, adapters and sealing seats which may result in leaks, breakage and potential for injury or damage to property. Applicable to Gates standard couplings with TuffCoat™ plating and assumes threads/seats are dry – with no oil or lubrication. If fitting to an intermediate adaptor, ensure this has been already tightened to a higher torque.

# INSTALLATION TORQUE VALUES

## SAE 37° & 45°

### MJ, FJX, MIIX, FSX

| | | | Nm | |
|---|---|---|---|---|
| -size | DN | | Min. | Max. |
| -2 | 3 | 5/16" - 24 | 8 | 10 |
| -3 | 5 | 3/8" - 24 | 11 | 14 |
| -4 | 6 | 7/16" - 20 | 15 | 19 |
| -5 | 8 | 1/2" - 20 | 19 | 24 |
| -6 | 10 | 9/16" - 18 | 24 | 30 |
| -8 | 12 | 3/4" - 16 | 49 | 61 |
| -10 | 16 | 7/8" - 14 | 77 | 96 |
| -12 | 20 | 1. 1/16" - 12 | 107 | 134 |
| -14 | 22 | 1. 3/16" - 12 | 127 | 159 |
| -16 | 25 | 1. 5/16" - 12 | 147 | 184 |
| -20 | 32 | 1. 5/8" - 12 | 172 | 215 |
| -24 | 38 | 1. 7/8" - 12 | 215 | 269 |
| -32 | 51 | 2. 1/2" - 12 | 332 | 415 |

## BSP 60° CONE

### MBSPT, MBSPP, FBSPORX

| | | | Nm | |
|---|---|---|---|---|
| -size | DN | | Min. | Max. |
| -2 | 3 | 1/8" - 28 | 9 | 12 |
| -4 | 6 | 1/4" - 19 | 15 | 18 |
| -6 | 10 | 3/8" - 19 | 26 | 31 |
| -8 | 12 | 1/2" - 14 | 41 | 49 |
| -10 | 16 | 5/8" - 14 | 50 | 60 |
| -12 | 20 | 3/4" - 14 | 70 | 80 |
| -16 | 25 | 1" - 11 | 105 | 125 |
| -20 | 32 | 1. 1/4" - 11 | 170 | 190 |
| -24 | 38 | 1. 1/2" - 11 | 225 | 250 |
| -32 | 51 | 2" - 11 | 360 | 420 |

## FLAT-FACED 'O' RING SEAL

### FFORX

| | | | Nm | |
|---|---|---|---|---|
| -size | DN | | Min. | Max. |
| -4 | 6 | 9/16" - 18UNF | 25 | 31 |
| -5 | 8 | 5/8" - 18UNF | 30 | 38 |
| -6 | 10 | 11/16" - 16UN | 40 | 50 |
| -8 | 12 | 13/16" - 16UN | 55 | 69 |
| -10 | 16 | 1" - 14UNS | 60 | 75 |
| -12 | 20 | 1. 3/16" - 12UN | 90 | 113 |
| -14 | 22 | 1. 5/16" - 12UN | - | - |
| -16 | 25 | 1. 7/16" - 12UN | 125 | 156 |
| -20 | 32 | 1. 11/16" - 12UN | 170 | 213 |
| -24 | 38 | 2" - 12UN | 200 | 250 |
| -32 | 51 | 2. 1/2" - 12UN | 510 | 638 |

## DIN SERIES

### MDL, MDH, MSP, FDLX, FDHX, FDLORX, FDHORX

| | | | Nm | |
|---|---|---|---|---|
| -size | | | Min. | Max. |
| Light Series | Heavy Series | | | |
| -6 | - | M12 x 1.5 | 13 | 17 |
| -8 | -6 | M14 x 1.5 | 23 | 28 |
| -10 | -8 | M16 x 1.5 | 33 | 38 |
| -12 | -10 | M18 x 1.5 | 38 | 42 |
| - | -12 | M20 x 1.5 | 48 | 52 |
| -15 | -14 | M22 x 1.5 | 52 | 58 |
| - | -16 | M24 x 1.5 | 62 | 68 |
| -18 | - | M26 x 1.5 | 80 | 90 |
| -22 | -20 | M30 x 2 | 105 | 115 |
| -28 | -25 | M36 x 2 | 125 | 135 |
| - | -30 | M42 x 2 | 200 | 220 |
| -35 | - | M45 x 2 | 205 | 225 |
| -42 | -38 | M52 x 2 | 290 | 310 |

# 0-RING BOSS

## MB, MBX

| -size | DN | | Nm | | | |
|---|---|---|---|---|---|---|
| | | | L Series | | S Series | |
| | | | Min. | Max. | Min. | Max. |
| -2 | 3 | 5/16" - 24UNF | 8 | 10 | - | - |
| -3 | 5 | 3/8" - 24UNF | 10 | 13 | 10 | 13 |
| -4 | 6 | 7/16" - 20UNF | 18 | 23 | 20 | 25 |
| -5 | 8 | 1/2" - 20UNF | 25 | 31 | 25 | 31 |
| -6 | 10 | 9/16" - 18UNF | 30 | 38 | 35 | 44 |
| -8 | 12 | 3/4" - 16UNF | 50 | 63 | 70 | 88 |
| -10 | 16 | 7/8" - 14UNF | 60 | 75 | 100 | 125 |
| -12 | 20 | 1. 1/16" - 12UN | 95 | 119 | 170 | 213 |
| -14 | 22 | 1. 3/16" - 12UN | 125 | 156 | 215 | 269 |
| -16 | 25 | 1. 5/16" - 12UN | 150 | 188 | 270 | 338 |
| -20 | 32 | 1. 5/8" - 12UN | 200 | 250 | 285 | 356 |
| -24 | 38 | 1. 7/8" - 12UN | 210 | 263 | 370 | 463 |
| -32 | 51 | 2. 1/2" - 12UN | 300 | 375 | 540 | 675 |

# NPTF PIPE

## MP

| -size | DN | | Nm | |
|---|---|---|---|---|
| | | | Min. | Max. |
| -2 | 3 | 1/8" - 27 | - | 25 |
| -4 | 6 | 1/4" - 18 | - | 35 |
| -6 | 10 | 3/8" - 18 | - | 45 |
| -8 | 12 | 1/2" - 14 | - | 60 |
| -12 | 20 | 3/4" - 14 | - | 75 |
| -16 | 25 | 1. 11" - 1/2 | - | 90 |
| -20 | 32 | 1. 1/4" - 11-1/2 | - | 110 |
| -24 | 38 | 1. 1/2" - 11-1/2 | - | 410* |
| -32 | 51 | 2. 11" - 1/2 | - | 475* |

* Thread sealant used, Gates recommends Vibra-Tite 42050 from ND Industries.

# SAE FLANGES CODE 61

## FL

| | | | Nm | |
|---|---|---|---|---|
| -size | DN | | Min. | Max. |
| -8 | 12 | M8 x 1.25 | 32 | 35 |
| -12 | 20 | M10 x 1.5 | 70 | 77 |
| -16 | 25 | M10 x 1.5 | 70 | 77 |
| -20 | 32 | M10 x 1.5 | 70 | 77 |
| -24 | 38 | M12 x 1.75 | 130 | 143 |
| -32 | 51 | M12 x 1.75 | 130 | 143 |
| -40 | 63 | M12 x 1.75 | 130 | 143 |
| -48 | 76 | M16 x 2 | 295 | 325 |

| | | | | |
|---|---|---|---|---|
| -8 | 12 | 5/16" -18 | 32 | 35 |
| -12 | 20 | 3/8" -16 | 60 | 66 |
| -16 | 25 | 3/8" -16 | 60 | 66 |
| -20 | 32 | 7/16" -14 | 92 | 101 |
| -24 | 38 | 1/2" -13 | 150 | 165 |
| -32 | 51 | 1/2" -13 | 150 | 165 |
| -40 | 63 | 1/2" -13 | 150 | 165 |
| -48 | 76 | 5/8" -11 | 295 | 325 |

# SAE FLANGES CODE 62

## FLH

| | | | Nm | |
|---|---|---|---|---|
| -size | DN | | Min. | Max. |
| -8 | 12 | M8 x 1.25 | 32 | 35 |
| -12 | 20 | M10 x 1.5 | 70 | 77 |
| -16 | 25 | M12 x 1.75 | 130 | 143 |
| -20 | 32 | M12 x 1.75 | 130 | 143 |
| -20 | 32 | M14 x 2 | 200 | 220 |
| -24 | 38 | M16 x 2 | 295 | 325 |
| -32 | 51 | M20 x 2.5 | 550 | 605 |

| | | | | |
|---|---|---|---|---|
| -8 | 12 | 5/16" -18 | 32 | 35 |
| -12 | 20 | 3/8" -16 | 60 | 66 |
| -16 | 25 | 7/16" -14 | 92 | 101 |
| -20 | 32 | 1/2" -13 | 150 | 165 |
| -24 | 38 | 5/8" -11 | 295 | 325 |
| -32 | 51 | 3/4" -10 | 450 | 495 |

# PERIODIC INSPECTIONS

Periodic hose assembly inspections can prevent unwanted and unexpected assembly failures. During normal operations, be aware of how the equipment sounds, feels, etc. Be sure to check any noticeable abnormalities.

Hose inspection can vary by equipment type. Refer to your equipment manual and always follow the manufacturer's inspection recommendations. If the recommendations are not available, use the following guidelines:

**Inspect mobile equipment every 400 to 600 hours or every three months, whichever comes first.**

**Inspect stationary equipment every three months.**

## OTHER FACTORS THAT INFLUENCE INSPECTIONS INCLUDE:

- Whether the equipment is critical to the operation.
- Operating pressures and temperatures.
- Difficult routing conditions.
- Extreme environmental factors.
- Accessibility of equipment.

## INSPECTION PROCEDURES

Here's a checklist to help keep your equipment running strong:

1. **First, turn off and lock out the equipment's power.**
2. **Place the equipment and components in a safe and/or neutral position.**
3. **Remove access panels and inspect hose and fittings for damage or leaks.**
4. **Repair or replace assemblies as needed.**
5. **Inspect other hydraulic components.**
6. **Reinstall access panels.**
7. **Turn power back on.**
8. **Pay attention to unusual noises, vibrations, etc.**

# HOSE TROUBLE-SHOOTING

The goal of troubleshooting is to identify the cause or causes of a hose failure, and then take the appropriate corrective action. Here's a list of some common causes of premature hose failure and some everyday solutions to correct the problems:

## 1. HOSE ABRASION

**Solution** - Reroute the hose to keep it away from abrasive sources or guard the hose with a protective sleeve.

## 2. HOSE BURST AT BODY

**Solution** - Inspect system operating pressure and select a hose that meets or exceeds the system's maximum pressure. Try rerouting the hose to prevent excessive flexing or keep the hose from exceeding its minimum bend radius.

## 3. HOSE BURST AT COUPLING

**Solution** - Increase the hose assembly's length to accommodate contraction under pressure; increase the hose bend radius or install bend restrictors; or replace the hose assembly with a properly crimped assembly.

## 4. LEAK AT THREAD END/SEAT

**Solution** - Remove the connection and inspect.

**A.** Certain couplings require the use of an O-ring. If it's missing, replace it. If an O-ring is used, check for damage caused during installation or possible material breakdown from heat or fluid incompatibility. Alternative O-ring materials may be required. Replace if necessary.

**B.** Check the threads and/or seat angles on both mating surfaces for damage that may have occurred prior to or during installation. Any ding or burr may be a potential leak path. Replace if necessary.

**C.** If the coupling was misaligned during installation, threads may have been damaged. Replace and carefully install.

**D.** It is possible to thread together some components that are not compatible. Use Gates thread ID kit to assist in identifying mating components. Some thread end configurations have better sealability than others. Also, ensure proper coupling selection.

**E.** Over-torquing of a threaded connection can damage threads and mating seat angles. Over-torquing can also damage the staking area of the nut, causing cracking of either the nut or seat. Under-torquing does not allow proper sealing. Use of a torque wrench can alleviate such problems.

## 5. WEEP AT HOSE/COUPLING INTERFACE

**Solution** - Whether it has been under-crimped or the stem has been improperly inserted, the hose assembly must be replaced with one that has been properly assembled.

## 6. COUPLING BLOWOFF

**Solution** - Examine and replace the hose assembly to ensure proper assembly procedures are followed. Modify hose length and/or routing to accommodate potential hose length reduction under pressure. Never mix different manufacturers' hoses, couplings or crimpers.

## 7. HOSE CRACKS

**Solution** - Select a hose that meets the temperature and flow requirements of the application. Also, identify the heat source and consider rerouting it away from the source to minimize the effects. Examine reservoir size (if necessary).

## 8. HOSE TWIST

**Solution** - Replace and reroute the hose to ensure that bending occurs only in one plane. The use of bent tube or block-style couplings and adapters may improve routing. Also, when installing the assembly, hold the backup hex to prevent it from turning and applying a twist. If male and female couplings are used on the same hose assembly, install the male (non-swivel) end first.

## 9. COVER BLISTERS

**Solution** - Replace the hose with one that is recommended as compatible with the fluid being used. If it is compressed gas, the cover can also be perforated (pinpricked) to allow the gas to seep through the cover. Textile hose covers also eliminate blistering. Bleed the system to eliminate any trapped air.

# GATES SAFE HYDRAULICS: THINK SAFETY

In Europe the main safety Directive covering hose and machinery products is the European Machinery Directive 2006 /42/EC. This provides the regulatory basis for the harmonisation of essential health and safety requirements for machinery at European Union level.

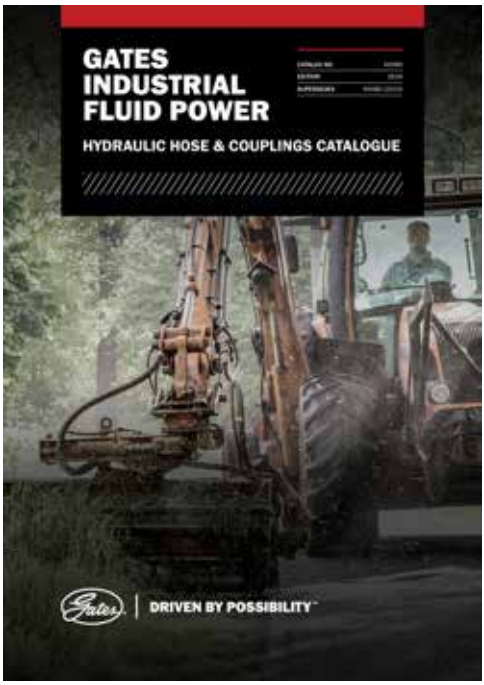
The Gates Integrated System of hoses, couplings, self assembly machines and crimp data – used together – helps you to comply with this European Machinery Directive.

Your safety and that of your workforce, your customer and the environment is always a top priority for us. That's why we offer our customers guidance on a safety and preventive maintenance via our Safe Hydraulics Programme.

The programme is designed by Gates application engineers and focuses on following topics:

- How to work safely and how to reduce your risks and protect the environment
- The entire safety process: storage, selection, installation and inspection
- How to avoid material and personal hazards and liability issues
- Expert information on safety issues affecting hydraulic hose assemblies

**You can contact your local Gates representative to find out more.**




- Fitting orientation
- Coupling identification
- Agency specifications
- Hydraulic fluids
- Hose storage life
- Proper installation torque values
- Crimper preventive maintenance
- Troubleshooting

**Gates has resources that can assist with your needs.**

- eCrimp™ helps you quickly find a hose and a hydraulic crimp specification, visit **ecrimp.gates.com** or download the mobile eCrimp app for more information
- For additional hydraulic product information, please consult the Knowledge Centre on **Gates.com**
- Gates technical experts are available to help, please contact your Sales representative
- For additional information, contact your local Gates hydraulic distributor or visit us online at **Gates.com**

# NOTES

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