

## MH HYDRAULICS TECH TALK #4 – HOW TO ENSURE HYDRAULIC HOSE SAFETY



In the previous tech talks, **MH Hydraulics FZC**, a leading hydraulic solutions provider in the Middle East, talked about oil contamination. In the September, October and November 2020 issues, we recognized the importance of **clean hydraulic oil** and **the ways to prevent oil contamination**.

**Hose Failure is one of the main causes of oil contamination.**

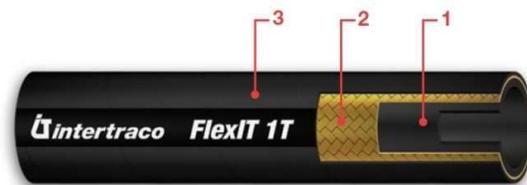
In this article, we explain the importance of choosing the right hose for your application. **A properly selected hose assembly will avoid early failure of the system and reduces the chances of oil getting contaminated** as dirt particles can enter the system during the hose assembly replacement.

A hydraulic system's hose assembly design needs to focus on the required working pressure, flow rate, medium, temperature and the application.

- 1) **Mis-application** - Perhaps the greatest cause of failure is using a hose, fitting, or clamp in an application that it is not designed for.
- 2) **Kinking at or near the fittings** - Once the barb of the fitting cuts into the tube of the hose, the product being conveyed can escape into the reinforcement and eventually lead to bubbling or blistering of the cover within several feet of the end.
- 3) **Temperature Exposure** - As temperature increases pressure ratings decrease. Excessive hot or cold temperatures will lead to discoloration, cracking, or hardness - as well the buildup of static electricity if hose wire has not been ground properly.
- 4) **Surging or excessive working pressure** - Usually a large burst with torn reinforcement, typically along the outside of a bend.
- 5) **External damage to hose carcass** - Kinks, crushed sections, and cover damage which exposes reinforcement will eventually break down the reinforcement and lead to a hose failure.

- 6) **Exceeding the minimum bend radius** - Kinking, crushing, or forcing a hose to bend beyond its minimum bend radius (measured from the inside edge of the hose, not the centerline). This is commonly seen on high pressure hoses or vacuum hoses.
- 7) **Defective hose or improperly installed or selected clamp** - Failure from a defective hose will typically occur in the first few hours of service, such as pin holes, blow-outs, or tube and cover separation. Improperly installed or selected clamps can result in the coupling ejecting from the end of the hose. Always confirm the manufacturer recommendations based on STAMPED information.
- 8) **Tube or cover not compatible with fluids or environment** - Usually results in discoloration, swelling, sponginess, or the breakdown of the hose carcass. For material handling hoses, always rotate to ensure even wear of the hose tube.
- 9) **Old age** - Hose is not 'pipe', it is a flexible component that will degrade over time. Shelf or service life will range from 1 to 20+ years, depending on its composition, application, and environment. Older hoses become discolored, stiff, or burst at low pressures.
- 10) **Incorrect hose length** - Too short of a length does not allow the hose to expand/contract due to changes in pressure or temperature and causes excessive stress on the fittings or hose reinforcement.
- 11) **Twisting hose during installation or service** - Twisting a hose rather than naturally bending the hose will reduce life. It is estimated a 7% twist when installing a hose in a permanent application can reduce hose life by 90%.
- 12) **Poor workmanship** - Hose and fittings are made of a unique blend of different materials with complex manufacturing methods - human error, inconsistent machinery, or poor product quality or raw materials can result in defects or variances greater than allowable tolerances. As for failure at the end fitting, ends blowing off assemblies can be a result of sub-standard coupling procedures or due to the "mixing-and-matching" of incompatible hose, couplings, or clamps.

There are various types of hose configurations available such as wire braided hoses, that too with single wire, double wire, 4 wire etc. depending on the application. Manufacturer's data sheets and guidelines are to be followed for selecting the right hose.



For example, the picture shows a single wire braided hose where the first inner layer is synthetic wire tube, intermediate layer is of high tensile steel wire braid and out cover is of

synthetic rubber. These are used for hydraulic oils, both mineral and biological; Polyglycol base oils, water/oil emulsions and water at temperature ranges 40°C to + 100 °C.

Many other types are available such as textile braided hoses, helical and spiral wire hoses, stainless steel corrugated hose etc. and is to be selected depending on the application. Proper selection is key to a safe hose assembly. Below shown chart is an example from Intertraco, a reliable supplier of hoses and fittings from Italy.

## PSI

| Intertraco hose type |        |      | FlexIT 1T  | FlexIT 2T  | FlexIT SK117 | FlexIT SK142 | FlexIT SC216 | FlexIT SC216 | FlexIT JF10K | FlexIT 3T | FlexIT PT | FlexIT SRP | FlexIT H4  | FlexIT S990 | FlexIT 6900 |
|----------------------|--------|------|------------|------------|--------------|--------------|--------------|--------------|--------------|-----------|-----------|------------|------------|-------------|-------------|
| Hose standard        |        |      | EN 853 1SN | EN 853 2SN | EN 857 1SC   |              | EN 857 2SC   | -            | -            | -         | -         | -          | EN 856 4SH | SAE 100 R13 | SAE 100 R15 |
| Ø mm                 | Ø inch | Size |            |            |              |              |              |              |              |           |           |            |            |             |             |
| 5                    | 3/16"  | -03  |            |            |              |              |              |              |              |           | 1800      |            |            |             |             |
| 6                    | 1/4"   | -04  | 3250       | 5800       | 4200         | 5000         | 5800         | 6500         | 10000        |           | 1800      | 6500       |            |             |             |
| 8                    | 5/16"  | -05  | 3100       | 5000       | 3600         | 4300         | 5000         | 6000         |              |           | 1800      |            |            |             |             |
| 10                   | 3/8"   | -06  | 2600       | 4800       | 3300         | 4000         | 4800         | 5500         | 10000        | 7200      | 1800      | 6500       |            |             |             |
| 12                   | 1/2"   | -08  | 2300       | 4000       | 3000         | 3500         | 4000         | 5000         |              | 8800      | 1800      | 6000       |            |             |             |
| 16                   | 5/8"   | -10  | 1900       | 3600       | 1900         |              | 3600         | 4200         |              |           |           | 5000       |            |             |             |
| 19                   | 3/4"   | -12  | 1500       | 3100       | 1500         |              | 3100         | 4000         |              | 5400      |           | 5000       | 6000       | 5000        | 6000        |
| 25                   | 1"     | -16  | 1250       | 2400       | 1250         |              | 2400         | 3300         |              | 4500      |           | 4000       | 5500       | 5000        | 6000        |
| 31                   | 1 1/4" | -20  | 920        | 1800       | 1430         |              |              |              |              |           |           | 3000       | 5000       | 5000        | 6000        |
| 38                   | 1 1/2" | -24  | 725        | 1300       |              |              |              |              |              |           |           | 3000       | 4350       | 5000        | 6000        |
| 51                   | 2"     | -32  | 580        | 1150       |              |              |              |              |              |           |           | 3000       | 3600       | 5000        | 6000        |
| 63                   | 2 1/2" | -40  | 580        | 1000       |              |              | 1000         |              |              |           |           |            |            | 5000        |             |
| 76                   | 3"     | -48  | 500        | 725        |              |              | 1000         |              |              |           |           |            |            |             |             |

You can select hoses which meet or exceed a certain isobaric line by following the colour coding:

|                    |   |                    |   |
|--------------------|---|--------------------|---|
| 210 bar / 3000 psi |  | 345 bar / 5000 psi |  |
| 275 bar / 4000 psi |  | 420 bar / 6000 psi |  |

Several factors are to be considered while selecting the hose fitting, including the compatibility of the fitting to the hose, one- or two-piece design and the correct assembly.

If possible, when a one-piece hose fitting can be used, it is highly recommended. This is to avoid selection mistakes.

One-piece hose fittings have a ferrule nipple that is built with the hose fitting. Many try to **re-use the existing nipple** when replacing hose fittings. **This is extremely unsafe.** Always use new components to assemble or repair hoses

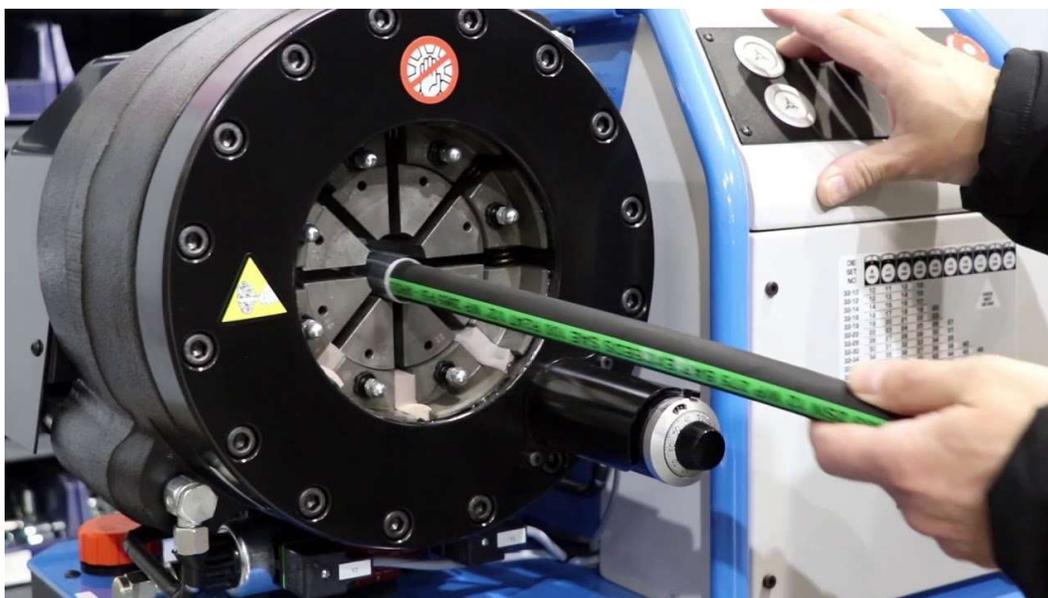
For hydraulic applications with extreme duty, skive hose assemblies are an option.



**Never cut a hose with an abrasive cutting disk.** Always use metal cutting blade. This is to avoid contamination. Improper cutting tools give a chance for rubber, metal and abrasive particles to enter the hose and will create oil contamination when put into operation.

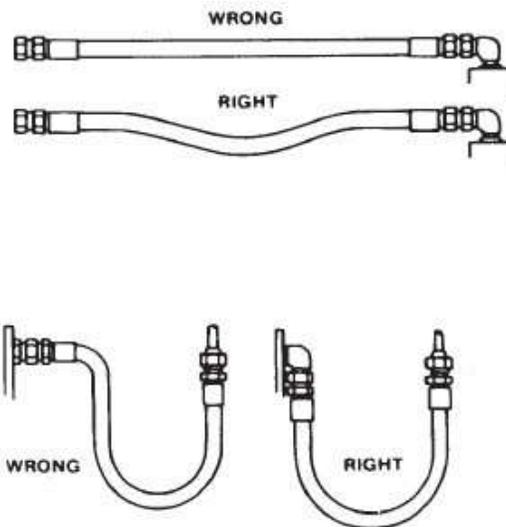


Correct equipment use for hose crimping is extremely important. Finn-power from Finland has many years of experience to create a reliable crimp.



Cleaning of hose using foam pigs wherever possible and use of shrink plugs while delivering would make sure no dust or particles inside the hose. Hoses which are subjected to external abrasion can be protected with external sleeves like that from Safeplast, in Finland.

For hydraulic hose reliability and minimizing hose stresses, it is important to adhere to the correct routing of hoses.



**To conclude**, hose assemblies are integral part of any hydraulic systems. Utmost care must be done in the selection, manufacturing and its installation. Selection of hose fittings must be done based on the design parameters. Recommended operations and methods are to be followed to build a reliable hose assembly. Installation techniques are to be followed. In our Tech Talk #5, we will explain hose storage, hose testing and reliable/clean hose packaging. By being aware of the above, a safe, leak proof, long life hydraulic system can be achieved. Remember, one of the main causes of oil contamination is hose failure, oil gets contaminated during the process of replacing damaged hoses and fittings. Hence making hose assemblies the first time right, saves time, money and unplanned equipment downtime.