

DIESEL MECHANIC



MINING QUALIFICATIONS AUTHORITY

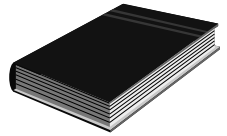
CODE: HYD - 12

MAKE UP HYDRAULIC HOSES

INDEX

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SOURCE REFERENCES

Demonstration by a competent person.

FESTO – Basic Level Textbook

OBJECTIVE

You will be learning towards the outcome “Make up hydraulic hoses”. Whilst learning towards the outcome you will be required to achieve the following:

- Select the hose and fittings and make up hydraulic hoses to specifications.
- Know the six rules for determining the length of a hose.
- Know the functions of an adaptor.

On completion of this module, the learner must be able to:

- Make up hydraulic hoses to specifications.
- State the six rules for determining the length of a hose.
- State the functions of an adaptor.

During this process you must adhere to certain specified requirements as listed in the Module.

ASSESSMENT AND EVALUATION CRITERIA

You will be assessed, when you are confident that you may achieve the outcomes as listed, to determine your competence as measured against the required criteria. This assessment will be in line with accepted best practices regarding assessment.

- A theoretical and practical assessment will be set during the module and must be completed without using reference.
- The learner will be required to answer all the questions without any reference.
- There must not be any damage to any equipment.

HAZARD IDENTIFICATION AND CONTROL (HIAC) FORM**HYD - 12****CONSTRUCT A CIRCUIT WITH
AN ACCUMULATOR**

STEPS IN OPERATION / PROCESS	POTENTIAL ACCIDENT / INCIDENT	CONTROLS (BY RESPONSIBLE PERSON)
1. Construct a hydraulic circuit.	<ul style="list-style-type: none"> Improper or careless handling of hydraulic components and pipes can lead to damage of equipment. 	<ul style="list-style-type: none"> Always handle components and pipes correctly, and with great care.
2. Use of hydraulic oil in a pressurised circuit.	<ul style="list-style-type: none"> Circuit under pressure. 	<ul style="list-style-type: none"> Wipe components and panel clean after use and store components. Ensure circuit is depressurised before removing components or pipes
3. Insure work area is safe	<ul style="list-style-type: none"> Oil in eyes and laceration of skin. Slip and fall. 	<ul style="list-style-type: none"> Wear correct PPE. Ensure working area is clean and safe. Wear correct safety boots.

NOTE: Before doing the practical work contained in this module, the learner must study the content of the above HIAC form again and then sign the statement below.

The above risks, which will be encountered in this module, are fully understood and will be controlled during the practical work.

Signature of learner:

Signature of Training Officer:

Date:

1. INTRODUCTION

ITEM / TASK: Hydraulic hoses.

DESCRIPTION:

- A. Hoses are used to convey fluid from one component to another. Hydraulic hoses do not only allow for flow, they absorb vibration and noise and withstand sudden surges of pressure. They are easy to lay out and connect.
- B. Hydraulic hoses consist of the following: (Fig 1)
- a. inner tube
 - b. reinforcement layers
 - c. top layer

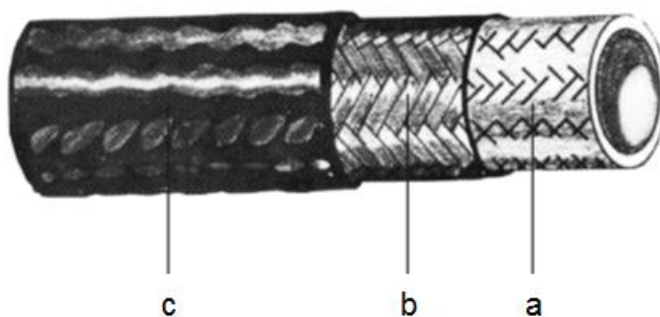


FIG 1.

a. **Inner tube**

The inner tube is made of synthetic rubber, teflon, polyester-elastomer, perbunan or neoprene. The pressure carrier is a woven intermediate layer of steel wire and/or polyester or rayon.

b. **Reinforcement layers (woven section)**

This reinforcement section may consist of one or more layers depending on the pressure range. The reinforcement layers vary with the type of hoses. These layers (or plies) are constructed of natural or synthetic fibres or braided wire, or a combination of these. The pressure requirements of the system where the hose is used determine the strength of these layers.

c. **Top layer**

The top layer is made of wear-resistant rubber, polyester, polyurethane elastomer or other materials. The top layer protects the reinforcement layers.

2. SELECTION OF HOSES

ITEM / TASK: Factors to take in consideration.

DESCRIPTION:

A. The maximum working pressure in the system must be known in order to select the correct hose. The maximum working pressure in a system, or a branch of it, is the pressure at which the pressure relief valve is set. Hoses are categorized by the strength of their wall construction.

B. The four types are:

- Fabric braid for low pressures. (Fig 2)
- Single wire braid for higher pressures. (Fig 3)
- Double wire braid for higher pressures. (Fig 4)
- Spiral wire for higher pressures. (Fig 5)

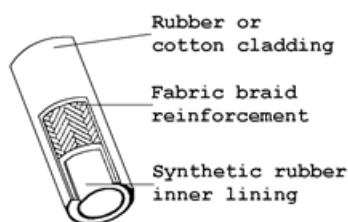


FIG 2.

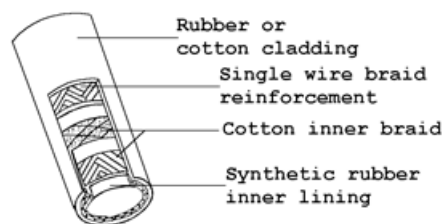


FIG 3.

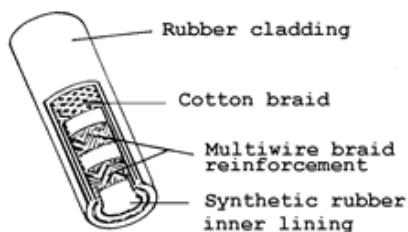


FIG 4.

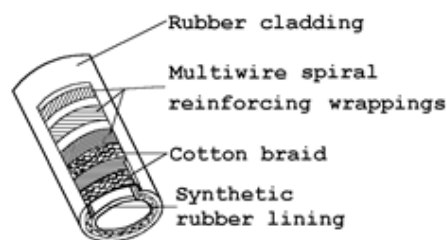


FIG 5.

C. High pressure hoses have walls with stronger reinforcing layers, or extra layers, than low pressure ones. To select the correct hose for any pressure application, refer to Table 1 on the next page.

TABLE 1 – HYDRAULIC HOSE CHART			
Hose size	Use single wire braid if the system pressure is not higher than:	Use double wire braid if the system pressure is not higher than:	Use spiral wire hose if the system pressure is not higher than:
6 mm	20 700 kPa	34 500 kPa	-
10 mm	11 500 kPa	27 600 kPa	34 500 kPa
12 mm	13 800 kPa	24 100 kPa	27 600 kPa
16 mm	11 700 kPa	19 000 kPa	-
19 mm	10 300 kPa	15 500 kPa	20 700 kPa
25 mm	5 500 kPa	12 900 kPa	20 700 kPa
31 mm	4 100 kPa	11 200 kPa	20 700 kPa
38 mm	3 400 kPa	8 600 kPa	20 700 kPa
50 mm	2 400 kPa	7 700 kPa	17 200 kPa

Find the size of hose needed in the left-hand column and read across horizontally to the nearest system working pressure greater than your application. If it is in column 1, use a single wire braid hose, if in column 2 use a double wire braid hose, or if it is in column 3, use a spiral wire hose.



NB:

The size is determined from the inside diameter of the hose. (Fig 6)

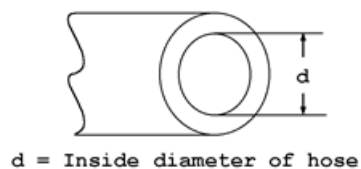


FIG 6.

3. DETERMINING THE LENGTH OF THE HOSE

ITEM / TASK: Rules.

DESCRIPTION:

To determine the length of a hose, six basic rules must be followed.

a. *Avoid taut hoses.*

Even where the hose ends do not move in relation to each other, allow some slack to prevent strain. Taut hoses tend to bulge and weaken under pressure. Refer to Fig 7.

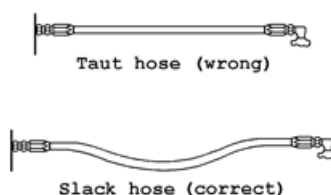


FIG 7.

b. *Avoid loops.*

Use angle fittings to prevent long loops. This cuts down on the length of hose needed and makes a neater installation. (Fig 8)

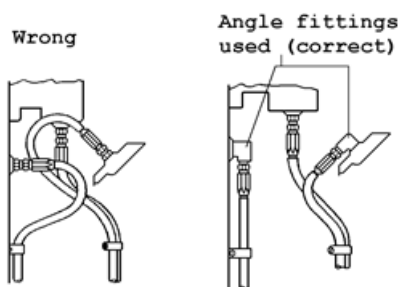


FIG 8.

c. *Avoid twisting.*

Hoses are weakened and fittings are loosened by twisting caused during the installation or by machine operation. (Fig 9)

Use a hose clamp (Fig 10), or allow some slack where necessary to prevent twisting.

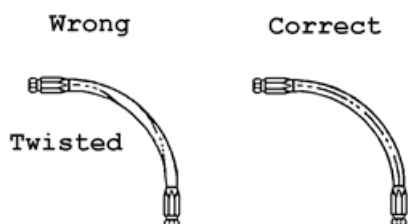


FIG 9.

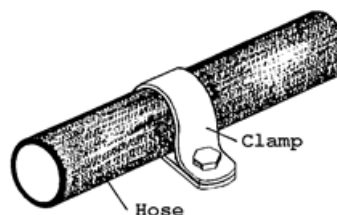


FIG 10.

d. *Avoid rubbing.*

Clamp or bracket hoses away from moving parts or sharp edges to prevent their rubbing against each other.

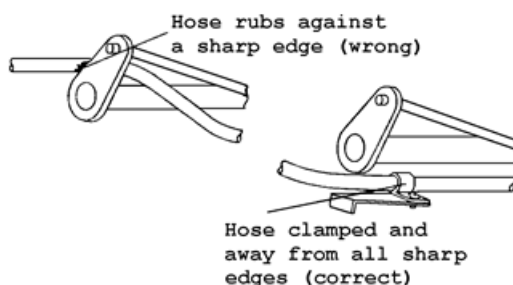


FIG 11.

e. *Avoid heat.*

Keep hoses away from hot surfaces e.g. engine manifolds. If the hoses cannot be routed away from these areas, shield them. (Fig 12)

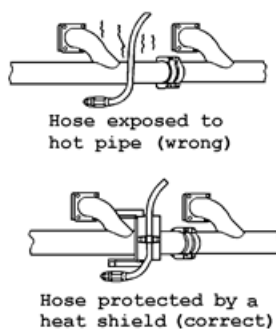


FIG 12.

f. *Avoid sharp bends.*

The bend radius depends upon the hose construction, size and pressure. Consult your supplier's catalogue for the limits for bending on each hose. (Fig 13)

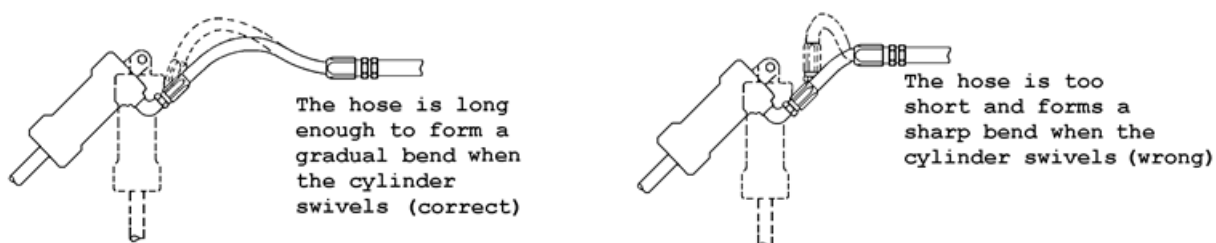


FIG 13.

4. HOSE COUPLERS

ITEM / TASK: Fittings and adaptors.

DESCRIPTION:

Hose couplers include two types:

- a. Fittings
- b. Adaptors.

a. **Fittings**

- The fitting forms a part of the hose as shown in Fig 14.

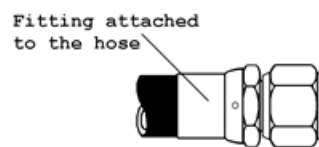


FIG 14.

- Hose fittings can seal in many ways. The five major methods are:
 - i. The thread seal to metal seal. (Fig 15)

When the two fittings are screwed together it forms a metal to metal seat

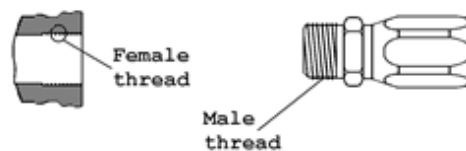


FIG 15.

- ii. The dry seal to 30° cone seat. (Fig 16)

Dry seal 30° cone seat

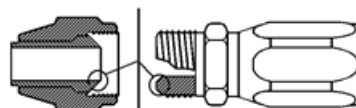


FIG 16.

- iii. The flare seal to cone seat. (Fig 17)

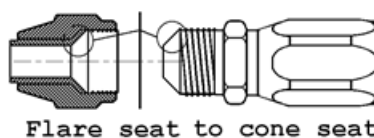


FIG 17.

Two types of flare seals are available:

- the JIC flare seal to 37° cone seat.
- the SAE flare seal to 45° cone seat.

iv. The O-ring seal. (Fig 18)

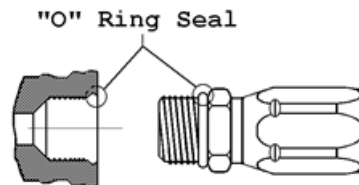


FIG 18.

v. The split flange O-ring seal. (Fig 19)

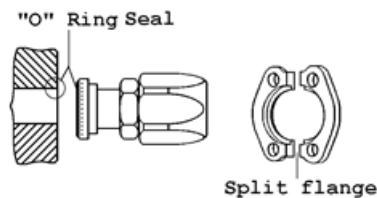


FIG 19.

- Hose fittings are also either permanent or re-usable. (Fig 20)

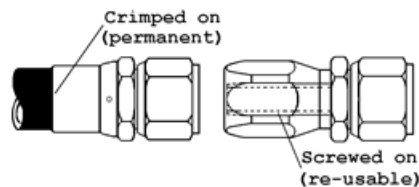


FIG 20.

- i. Permanent hose fittings are discarded with the hose. They are either crimped or swaged onto the hose.
- ii. Re-usable fittings are either push on, screwed on, or clamped onto the hose. When the hose wears out, the fittings can be removed and used again.
- iii. To select the correct fitting for the pressure in the system, you must consult the supplier's catalogue.

b. **Adaptors**

- A hose adaptor is a separate part and is used for joining a hose fitting to another line or fitting.
- Adaptors are used in four ways, namely:
 - i. To join a hose fitting to a component. (Fig 21)

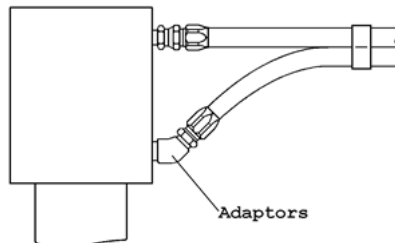


FIG 21.

- ii. To connect two or more lines or fittings. (Fig 22)

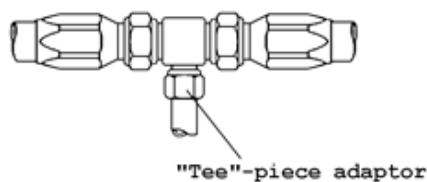


FIG 22.

- iii. To replace a bushing as a reducer. (Fig 23)

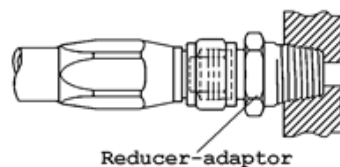


FIG 23.

- iv. To both anchor and connect lines. This adaptor is called a bulkhead coupler. (Fig 24)

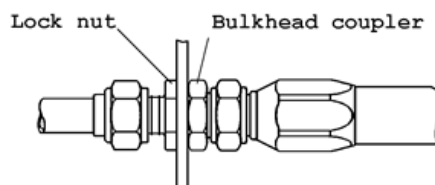


FIG 24.

**DO THE SELF TEST ON THE NEXT PAGE
BEFORE CONTINUING WITH THE REST OF THE MODULE.**



SELF TEST

Refer to Table 1 and answer the following questions :

1. Select the type of hose to be used for the following conditions :

i. Inside diameter of the hose : 50 mm

Pressure : 10 000 kPa

ii. Inside diameter of the hose : 25 mm

Pressure : 12 000 kPa

iii. Inside diameter of the hose : 6 mm

Pressure : 20 000 kPa

Check your answers with those given on the next page.

2. What six rules must be followed to determine the length of the hose?

3. What is the function of a hose fitting?

4. What is the function of an adaptor?

Answers to Question 1.

- i. Spiral wire reinforced hose.
- ii. Double wire braid reinforced hose.
- iii. Single wire braid reinforced hose.

Ask your Training Officer to check your work and if it is correct, to sign below.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

5. MAKING UP A HYDRAULIC HOSE WITH A RE-USABLE FITTING

ITEM / TASK: Method.

DESCRIPTION:

This method must be performed by a specialised person only.

To make up a hydraulic hose, the following method can be followed:

- Select the proper type of hose from the pressure chart. (Table 1)
- Select the fittings making sure that:
 - a. The pressure rating of the fitting corresponds to the working pressure rating of the hose. (Consult the supplier's catalogue).
 - b. The sealing method of the fitting matches the sealing method of the adaptor.
 - c. The threads on the fitting correspond with the threads of the adaptor.
- Determine the length of the hose by following the six basic rules.
- Cut the length of hose required with a suitable cutter.
- When the outside diameter of the hose is too large to screw into the socket, you must strip off the protective cover by cutting around the hose and down to the metal wire reinforcement, then cut lengthwise and pull off the cover. (Fig 25)

X = Length of
outer cladding to
be stripped off
and the depth that
the hose must
enter into the
socket

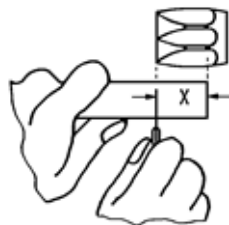


FIG 25.

- Clean the wire with a wire brush.
- Screw the hose anti-clockwise into the socket until it bottoms. (Fig 26)

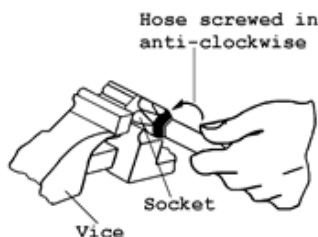


FIG 26.

- Oil the nipple threads and the inside of the hose liberally. This will prevent the nipple damaging the inner tube when it is screwed into the pipe. (Fig 27)

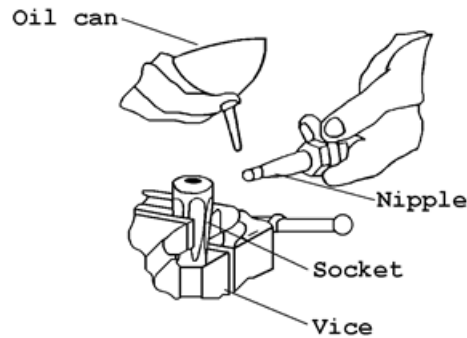


FIG 27.

- Screw the nipple clockwise into the socket. Leave a clearance of 0.75 mm to 1.5mm between the nipple and the socket. (Fig 28)

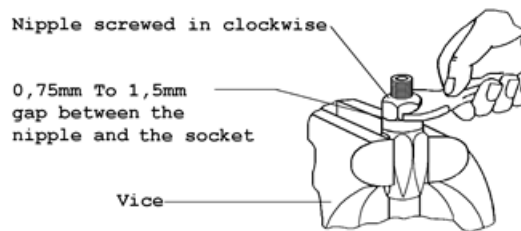
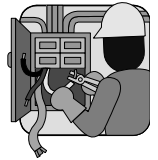


FIG 28.

**DO THE PRACTICE ON THE NEXT PAGE
BEFORE CONTINUING WITH THE REST OF THE MODULE.**



PRACTICE

Fit a re-usable fitting to one of the following pipes. (One side only)

- 6mm inside diameter for a circuit with a maximum working pressure of 20 000 kPa.
- 12mm inside diameter for a circuit with a maximum working pressure of 20 000 kPa.
- 19mm inside diameter for a circuit with a maximum working pressure of 20 000 kPa.



NB:

DO NOT CUT THE PIPES BECAUSE THIS WILL BE VERY COSTLY.

Ask your Training Officer to check your work and if it is correct, to sign below.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :



REMEMBER ALWAYS WORK SAFE

Once you have passed the entire practices, you are now at liberty to request a Formative Assessment from your Assessor.