UEE11 Electrotechnology

Training Package

UEENEEJ102A
Prepare and connect refrigerant tubing and fittings

Learner Workbook

Version 1

Training and Education Support
Industry Skills Unit
Meadowbank

Product Code: 5624

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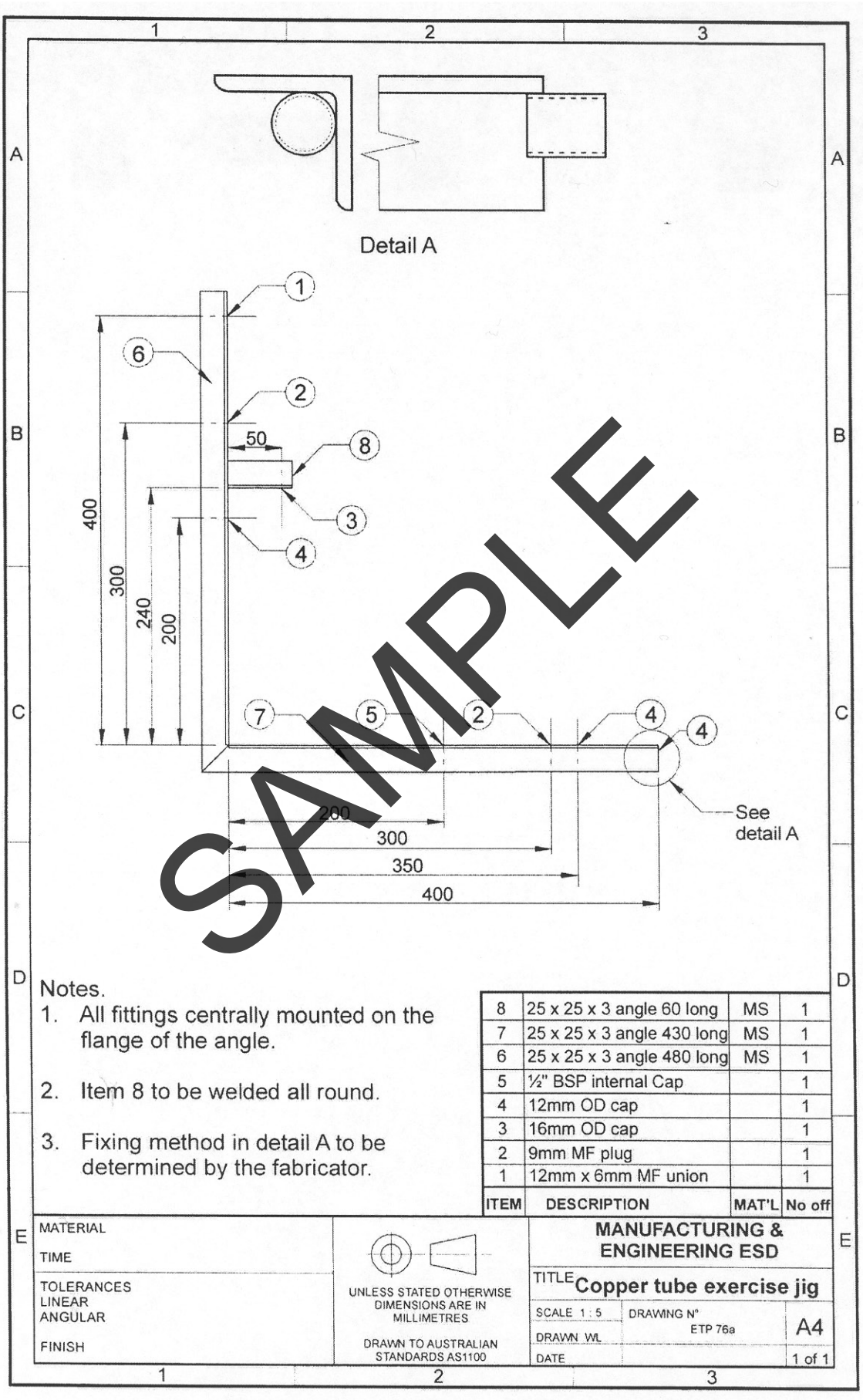

Notes.

1. All fittings centrally mounted on the flange of the angle.
2. Item 8 to be welded all round.
3. Fixing method in detail A to be determined by the fabricator.

ITEM	DESCRIPTION	MAT'L	No off
8	25 x 25 x 3 angle 60 long	MS	1
7	25 x 25 x 3 angle 430 long	MS	1
6	25 x 25 x 3 angle 480 long	MS	1
5	½" BSP internal Cap		1
4	12mm OD cap		1
3	16mm OD cap		1
2	9mm MF plug		1
1	12mm x 6mm MF union		1

MATERIAL

TIME

TOLERANCES
LINEAR
ANGULAR

FINISH

UNLESS STATED OTHERWISE DIMENSIONS ARE IN MILLIMETRES

DRAWN TO AUSTRALIAN STANDARDS AS1100

MANUFACTURING & ENGINEERING ESD

TITLE Copper tube exercise jig

SCALE 1 : 5 | DRAWING N° ETP 76a | A4

DRAWN WL | DATE | 1 of 1

Notes:

Section 1 - Piping

Purpose

In this section you will learn to describe and identify various types of tubing and pipe insulation.

Topics

- Refrigeration and water grade copper tube
- Maintaining cleanliness (always capped, do not blow out with mouth etc)
- Soft and hard drawn tube
- Tubing applications (soft, hard, pair coil, water grade etc)
- Tube qualities – diameter, wall thickness (gauge) and pressure ratings (410A etc)
- Pipe insulation (types – tube, slit tube, sheet etc and joining methods – glue, tape etc)
- Other tube materials (bundy, steel, aluminium, brass).

Learning Objectives

At the end of this section you should be able to:

- State the differences between refrigeration grade and water grade tubing
- Explain the need to maintain tube cleanliness
- Describe the terms "hard" drawn and "soft" drawn in relation to copper tube
- List suitable applications for the various types of tubing/piping
- Identify various tube diameters, wall thicknesses and their respective pressure ratings
- Identify the various types of pipe insulation and list approved methods of fixing and joining
- List other metals used for tubing in the trade and state their common uses.

References

You will find the technical information to undertake this section in the following references:

Types of Tubing

- ARAC, 4th Edition, Volume 1, Chapter 9 - Specialised Tools
- AS/NZS 1571 Copper – Seamless Tubes for Air Conditioning and Refrigeration
- AS 1432 Copper Tubes for Water, Gas and Sanitation
- Kembla Copper – Refrigeration and air Conditioning tube brochure.

Tubing Cleanliness

- ARAC, 4th Edition, Volume 1, Chapter 9 (See "Annealed Copper Tubing" for details)
- AS/NZS 1571 Copper – Seamless Tubes for Air Conditioning and Refrigeration.

Learner exercises

Skill Practice 1.1: Piping

Additional Information

The most common types of refrigerant tubing are:

- **Annealed** (soft drawn) - has been heated to a "cherry red" (approximately 650°C) and then allowed to cool or quenched which makes it flexible, and easy to bend and flare. Copper tube used for refrigeration purposes is capped and dehydrated, which is essential to ensure that no contaminants are introduced into the system during installation or repair. Sold in rolls/coils and needs to be rolled out carefully so as not to distort the tubing. Type B tubing (AS 1432) is used for most applications.
- **Hard drawn** - used in commercial refrigeration and air conditioning applications. The tubing is hard and stiff and therefore should not be bent. Available in 6 metre lengths.
- **Steel** (bundy tube) - used in domestic refrigeration and with ammonia systems because of ammonia's reaction with non-ferrous metals. Normally has a welded seam running down the centre of the tubing.
- **Stainless steel** - is very strong and resistant to corrosion. Used extensively in connection with food processing (ice cream, milk handling). Can be used with ammonia refrigeration.
- **Flexible** - is as it says, flexible. Used were refrigeration lines must be kept flexible or where there are large amounts of vibration/movement present. They are metal or nylon braded with a resilient outer covering of polyethylene (motor vehicle air conditioning).

Note: All these tubing materials are suitable for use with all common refrigerants, except that copper and brass must not be used with ammonia, because in the presence of moisture, ammonia will attack non-ferrous metals.

PIPE WALL THICKNESS AND SAFE WORKING PRESSURES

Actual Metric Tube size (mm)	Safe Working Pressure (kPa)	Safe Working Pressure (kPa)	Safe Working Pressure (kPa)	R410A Compliant
Outside Diameter x Wall Thickness	**@ 50°C**	**@ 65°C**	**@ 75°C**	
6.35 x 0.81	10 635	9 545	8 820	Yes
6.35 x 0.91	12 140	10 900	10 070	Yes
7.94 x 0.81	9 430	8 465	7 820	Yes
9.52 x 0.81	6 800	6 105	5 640	Yes
9.52 x 0.91	7 720	6 930	6 400	Yes
12.70 x 0.81	4 995	4 480	4 140	Yes
12.70 x 0.91	5 655	5 075	4 685	Yes
15.88 x 0.81	3 945	3 539	3 266	Yes
15.88 x 1.02	5 030	4 515	4 170	Yes
19.05 x 1.14	4 670	4 190	3 870	Yes
19.05 x 1.22	5 015	4 500	4 160	Yes
22.22 x 1.63	5 795	5 205	4 805	Yes
28.58 x 1.83	5 015	4 500	4 160	Yes
34.92 x 2.03	4 525	4 065	3 755	Yes @ 3800 kPa shut off Limit
41.28 x 2.41	4 550	4 080	3 770	Yes @ 3800 kPa shut off Limit

R410A Pressure @65°C = 4131kPa

Table courtesy of Kembla Tube and Fittings

Skill practice 1.1: Piping

Task

To identify and list various tubing types and their suitable applications.

Objectives

At the completion of this skill practice, you should be able to:

- Describe the difference between "soft" drawn and "hard" drawn copper tube
- Identify various tube diameters
- List suitable applications for various types of tubing/piping
- List other metals used in the industry and state their common uses.

Planning the Skill Practice

Equipment

Your teacher will provide you with the details of the equipment to be used, for example:

- Copper tubing both "soft" and "hard" drawn in a variety of sizes. (E.g. 9 mm, 12 mm, 16 mm, etc)
- Copper tubing suitable for high pressure refrigerants (R410A etc)
- Various examples of pipe insulation (tube, slit tube, sheet etc)
- Pipe insulation glue and tape
- Various examples of other metals – at least three examples to be identified (e.g. bundy tube, aluminium tube, brass tube, flexible tube).

Safety

Remember:

- In the workshop always wear: safety glasses, safety boots, hair protection and suitable clothing
- Know where the First Aid station is
- No running or horseplay
- Be careful how you lift heavy objects
- Be careful of tools with sharp points
- Keep work area and floor area clear: then there will be fewer accidents.

Risk Assessment

Identify any hazards, list the supervision level (D, G or B), list the risk class (A, B or C) and list control measures required in the table below:

Hazard Identification	Supervision Level	Risk Class	Control Measures

Carrying Out the Skill Practice

Procedures

Fill out the tables below using the examples supplied for the exercise:

Copper tubing sample	Soft or hard drawn	Diameter	Wall thickness	Suitable for R410A	Common application
A	**YES**	**9 mm**	**0.9 mm**	**NO**	**Domestic Air Conditioning**
B					
C					
D					
E					
F					

Other metal samples	Common application
A	
B	
C	
D	

Completion of the Skill Practice

1. List and describe any safety hazards which may have occurred during the skill practice that were NOT identified during the risk assessment and the actions used to control the risk.

2. List and describe any unforeseen event that occurred during the skill practice.

3. Describe the key points you have learnt while carrying out this skill practice.

Review questions

These questions will help you revise what you have learnt in this topic.

1. Name **four** (4) commonly used refrigerant piping materials?

   - _____
   - _____
   - _____
   - _____

2. List **three** (3) advantages of using copper tube for refrigerant piping.

   - _____
   - _____
   - _____

3. Copper tubing can not be used with ammonia refrigerant. In your own words, please explain why.

   _____

   _____

4. When measuring the diameter of refrigerant copper tube, do you measure the inside or outside diameter of the refrigerant tubing?

   _____

5. How should copper tube be stored?

   _____

6. Why is refrigeration grade copper tubing dehydrated and capped during manufacture?

   _____