M E C H A N I C A L

M A N U A L

TNT HARBOURLINK MONORAIL

C O N T E N T S

C H A P T E R 1

INTRODUCTION

TNT HARBOURLINK MONORAIL

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TNT Harbourlink Monorail is a rapid, quiet and convenient means of transport for passengers travelling between Sydney's central city area and the Darling Harbour facilities.

The Monorail transport system comprises six trains automatically controlled to run at approximately equal distances apart along an overhead track. The trains travel anti-clockwise around the 3.6 km circuit.

On average the trains complete a round trip of the monorail circuit in approximately 12 minutes.

Each train has a maximum capacity of 161 passengers and a maximum operating speed of 33 km/h.

When all six trains are in operation, the interval between trains at each station is approximately 2 minutes, and the system is at its maximum carrying capacity of 5000 passengers per hour.

The number of trains kept in operation is varied to match daily and seasonal changes in passenger demand.

The Monorail Trains

Each train comprises seven cars; a forward car, a rear car and five intermediate cars, as shown in Figure 1.1.

The train is carried on eight pairs of pneumatic rubber tyred wheels; one pair under the front of the forward car, one pair under the back of the rear car and one pair under each of the six inter-connections between the cars.

The wheels under the front of the forward car and the back of the rear car are idler (non-driven) wheels; they support their respective cars, but take no part in providing motion to the train. Each of these pairs of wheels is mounted on an idler bogie.

The wheels under the interconnections between the cars are the drive wheels. Each pair is driven by an individual 37 kW DC electric motor transmitting power to the drive wheels via the secondary shaft and limit slip differential of a drive wheel gearbox. An extension of the gearbox secondary shaft is connected into an electromagnetically operated disc brake assembly.

As well as being the means of driving the train, the electric motors act as the normal means of decelerating and stopping the train; when the power supply to the motors is switched off, the motors behave as generators and absorb the kinetic energy that the train has in motion. The disc brakes are normally used only as parking brakes; they are used to decelerate and stop the train only in emergency situations.

Each pair of drive wheels, together with its electric motor, gearbox and brake assembly, is mounted on a drive bogie.

The drive bogies and idler bogies are each similarly equipped with four side-thrust guide wheels and four up-thrust guide wheels, two of each on each side of the bogie. The side-thrust guide wheels run against the side walls of the monorail track, whilst the up-thrust guide wheels run against the lower surface of the top flange of the track.

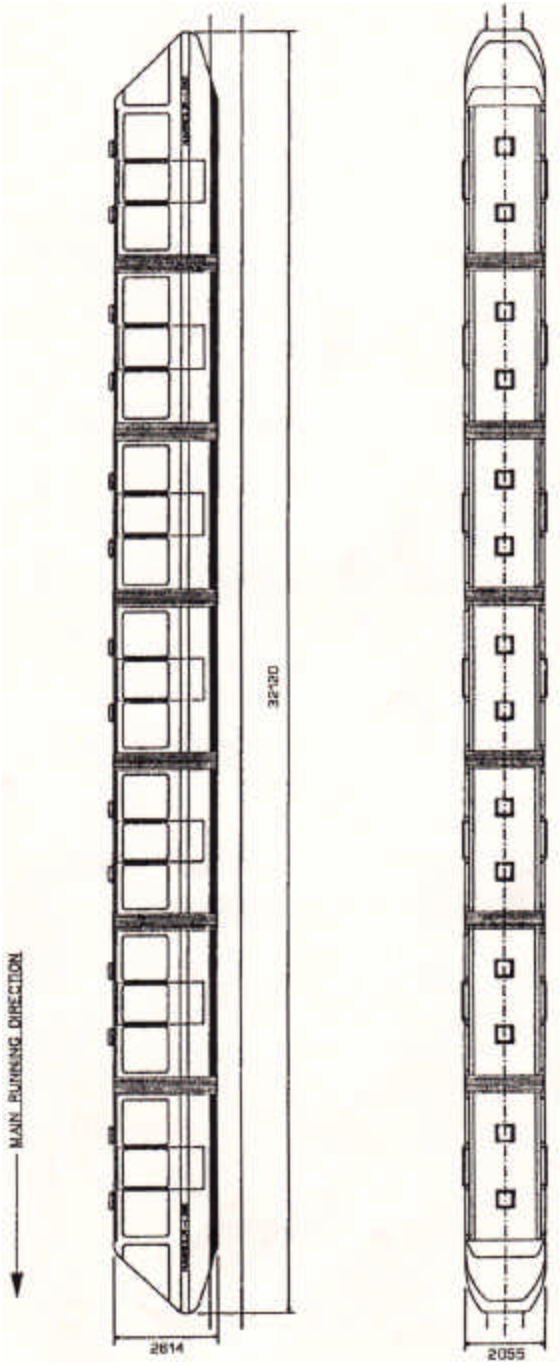

FIGURE 1.1

COMPOSITION OF MONORAIL TRAIN

The two cars interconnecting at each drive bogie location are coupled to the drive bogie via an assembly which includes spherical joints to provide articulation between the two cars, shock absorbers and a pressure adjustable air spring.

As well as operating as an auxiliary shock absorber, the air spring has its pressure automatically regulated to adjust the car floor level to station platform level regardless of changes in passenger loading.

Air for adjustment of air spring pressures is provided from an air compressor mounted in the back of the train's rear car. An air reticulation system runs the length of the train, and includes air receivers and air tube connectors at the interconnections between cars.

Each monorail car has two electric motor driven sliding doors; one either side of the train to allow for stations being situated on one side or the other of the monorail track. The opening and closing of doors and the selection of which side of the train is to have its doors operated is automatically controlled.

In the event of train power failure, each door may be unlocked by manual operation of a release button located above the door on the outside of the train. The door may then be slid open by hand.

In the event of any train losing its drive power, it may be towed by another train. For this purpose, the forward and rear cars of each train are equipped with a tow bar coupling assembly.

In the event of total power loss to the track two options are available to move the trains:

i. The trains may be individually towed by track-riding petrol engine driven vehicle referred to as a "mule". This vehicle is normally parked at the Monorail Maintenance Facility.

ii. The standby generator at the monorail maintenance facility may be used to provide limited power to the track - sufficient to move one train at a time.

Organisation Of The Maintenance Manual

To provide a complete understanding of the monorail train and associated system components, the manual firstly describes each major assembly, its sub-assemblies and their components.

The manual then presents procedures for completely disassembling each major assembly into its sub-assemblies and their individual components, followed by procedures for complete re-assembly.

The manual then presents instructions for daily, weekly and monthly preventative maintenance tasks on each major assembly; each task requiring that the assembly be accessed or disassembled to a greater or lesser extent.

Having once completed each of the prescribed maintenance tasks, it will be unnecessary to refer to this manual in full to undertake the same task on a future occasion. What will be necessary is a reminder of the particular adjustment dimensions, torque and special precautions applicable to each task. -

Such reminders are included in Preventative Maintenance Schedules presented in Appendix 1 of this manual.

On the drawings, components are each identified by a number.

Where the number is of four digits, these are the last four digits of the complete and longer part number of a component manufactured by Von Roll Transport Systems, e.g. the complete part number of the Mounting Plate (1622) is 4/21.01622.

Where the number is of only one, two or three digits, it is an identification number of a component not manufactured by Von Roll Transport Systems.

Complete part numbers and descriptions of components manufactured by Von Roll Transport Systems are presented in Appendix II of this manual.

Pneumatic system component drawings are parts lists are presented in Appendix Ill of this manual.

C H A P T E R 9

MONORAIL

CAR

TNT HARBOURLINK MONORAIL

CAR LIFTING PROCEDURE

MONORAIL CAR

2.0 CAR LIFTING PROCEDURE

If a car requires maintenance to such major extent that it is not feasible or practical to perform the work on the maintenance track, it will be necessary to remove the car for maintenance to be performed elsewhere.

Removal of a forward or rear car from the maintenance track should be performed just as for removal of an idler bogie from the train, as described in Chapter 3 Section 3.1.

Removal of an intermediate car from the maintenance track should be performed in accordance with the following procedure:

1. Remove the drive bogie astern of the car, as described in Chapter 2 Section 3.1

2. Disconnect the car from the drive bogie ahead of the car, as described in Chapter 2 Section 3.1

3. Suspend the car lifting frame on the overhead travelling crane, attach the four "Span Set" lifting belts to the frame and position the crane over the car so that the lifting belts hang each side of the car at exactly the positions indicated in Figure 9.1.

4. Install the four lifting hooks at the positions indicated, attach the lifting belts to the hooks and lift the car from the track with the overhead travelling crane.

SAFETY PRECAUTIONS

Locate the lifting hooks exactly at the positions indicated in Figure 9.1. Locating the hooks in different positions will decrease the stability of the suspended car, and will subject the car to forces likely to deform the car frame.

Ensure that the lifting belts are not twisted, and that they are correctly attached to the lifting frame and the hooks.

Do not stay or allow anyone else to stay under the car, whilst it is being lifted.

Note: Details of the lifting frame, lifting hooks and lifting slings are shown in Figures 9.2, 9.3 and 9.4.

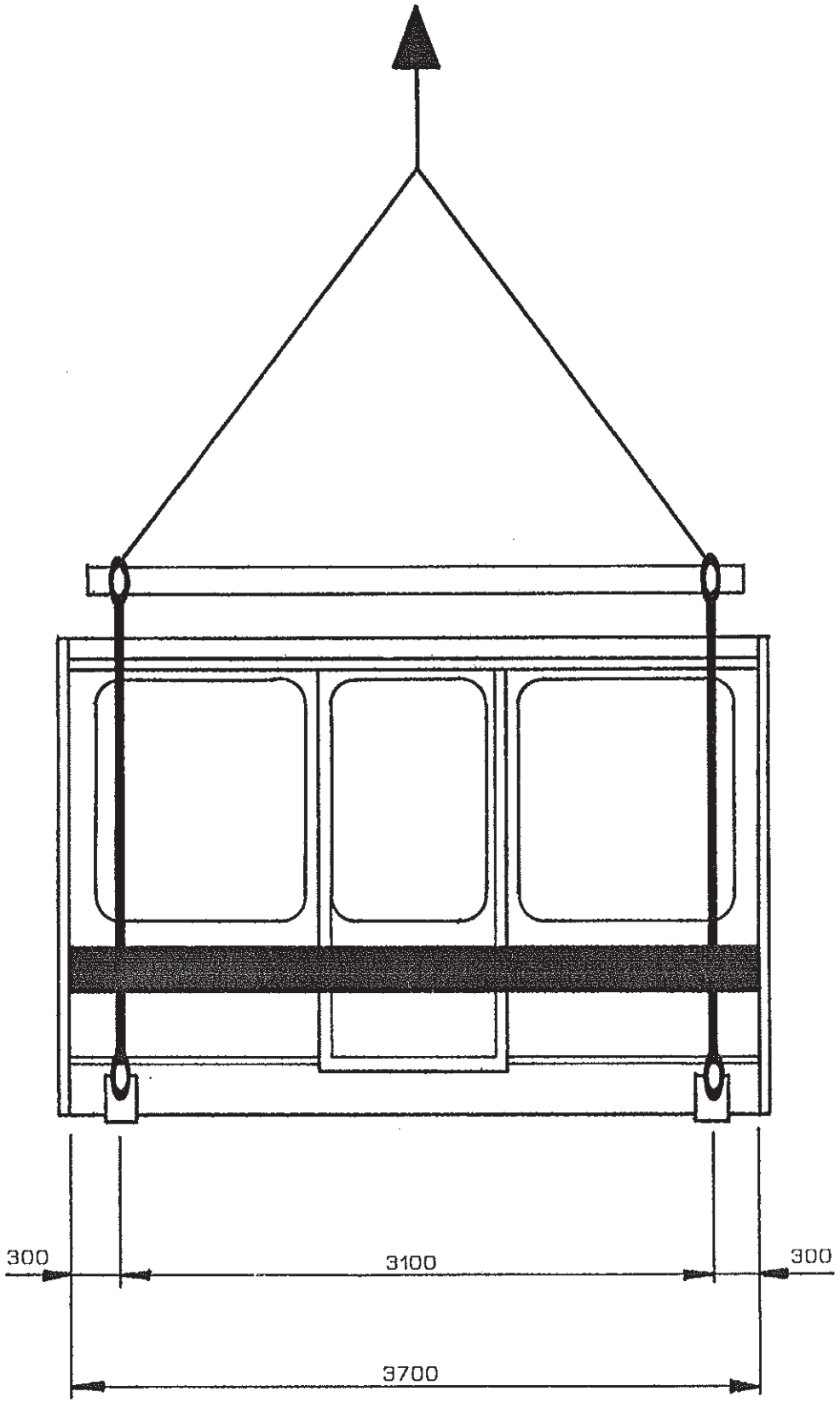

FIGURE 9.1

INTERMEDIATE CAR LIFTING POINTS

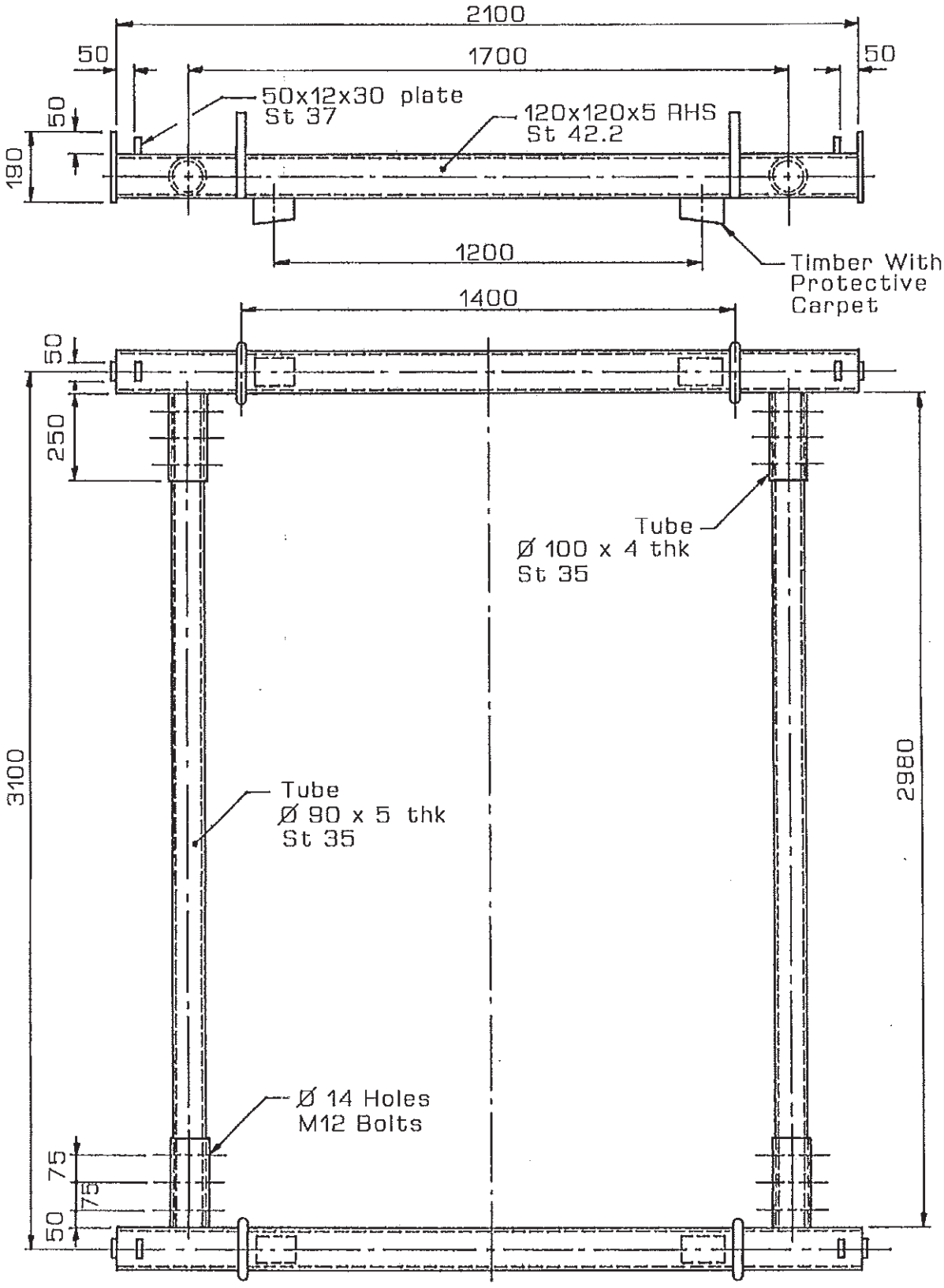

FIGURE 9.2

CAR LIFTING FRAME

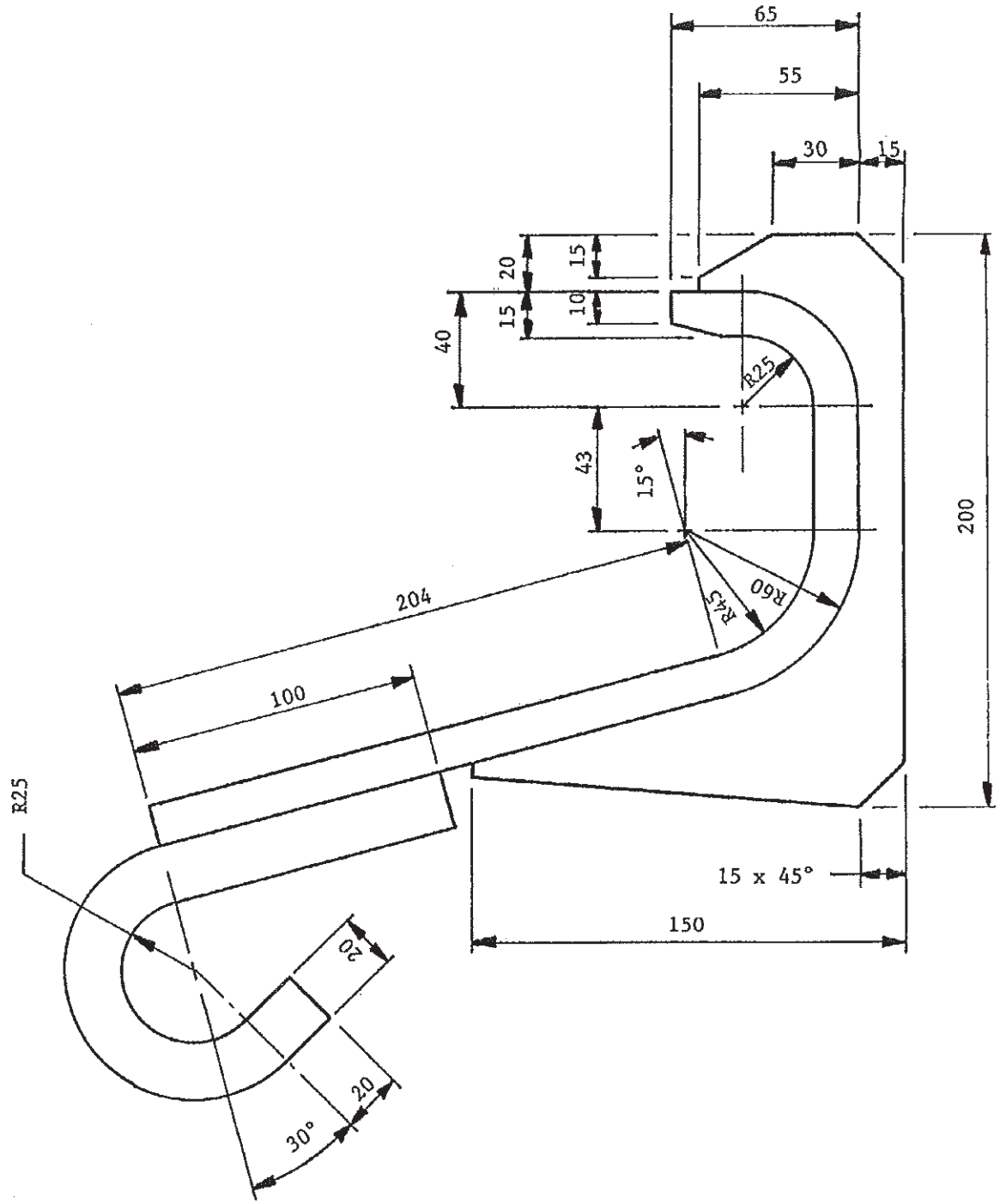

FIGURE 9.3

LIFTING HOOK

TYPE B DUPLEX SLING (2 PLY) REINFORCED LOOPS						MODE OF USE – SAFETY FACTOR 8 LOAD CAPACITY kg			
TYPE	COLOUR	B = mm	A = mm	L = OVERALL LENGTH mm	S = mm	SIMPLE DIRECT	SIMPLE TWISTED	SIMPLE FOLDED, FOLDING ANGLE $<\beta$ $<60°$	$<\beta\leq 45°$	$<\beta\leq 60°$
B 26	OLIVE	26	26	1000	300	600	480	1200	850	600
B 50	BROWN	50	30	1000	300	1250	1000	2500	1750	1250
B 60	RED	65	35	1000	400	1500	1200	3000	2100	1500
B 80	YELLOW	75	40	1500	400	2000	1600	4000	2800	2000
B 100	GREY	100	50	1500	400	2500	2000	5000	3500	2500
B 120	VIOLET	140	70	1500	600	3000	2400	6000	4200	3000
B 200	BLUE	200	105	2500	800	5000	4000	10000	7000	5000
B 320	ORANGE	300	160	2500	800	8000	6400	16000	11200	8000

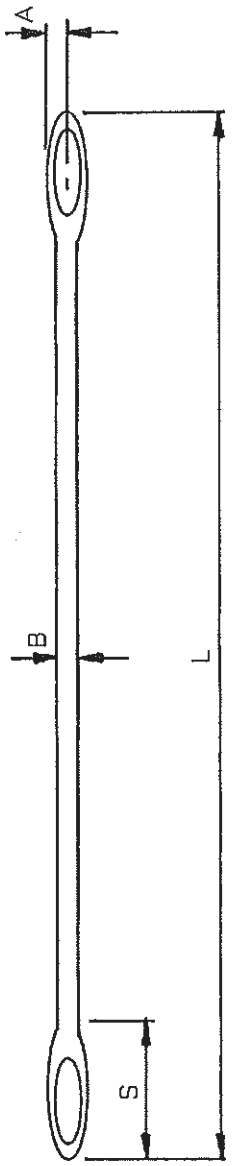

FIGURE 9.4

LIFTING SLINGS