



# Service Manual

## **JS200**

from machine no. 705001

## **JS210**

from machine no. 705648

## **JS220**

from machine no. 705001

## **JS240**

from machine no. 708001

## **JS260**

from machine no. 708501

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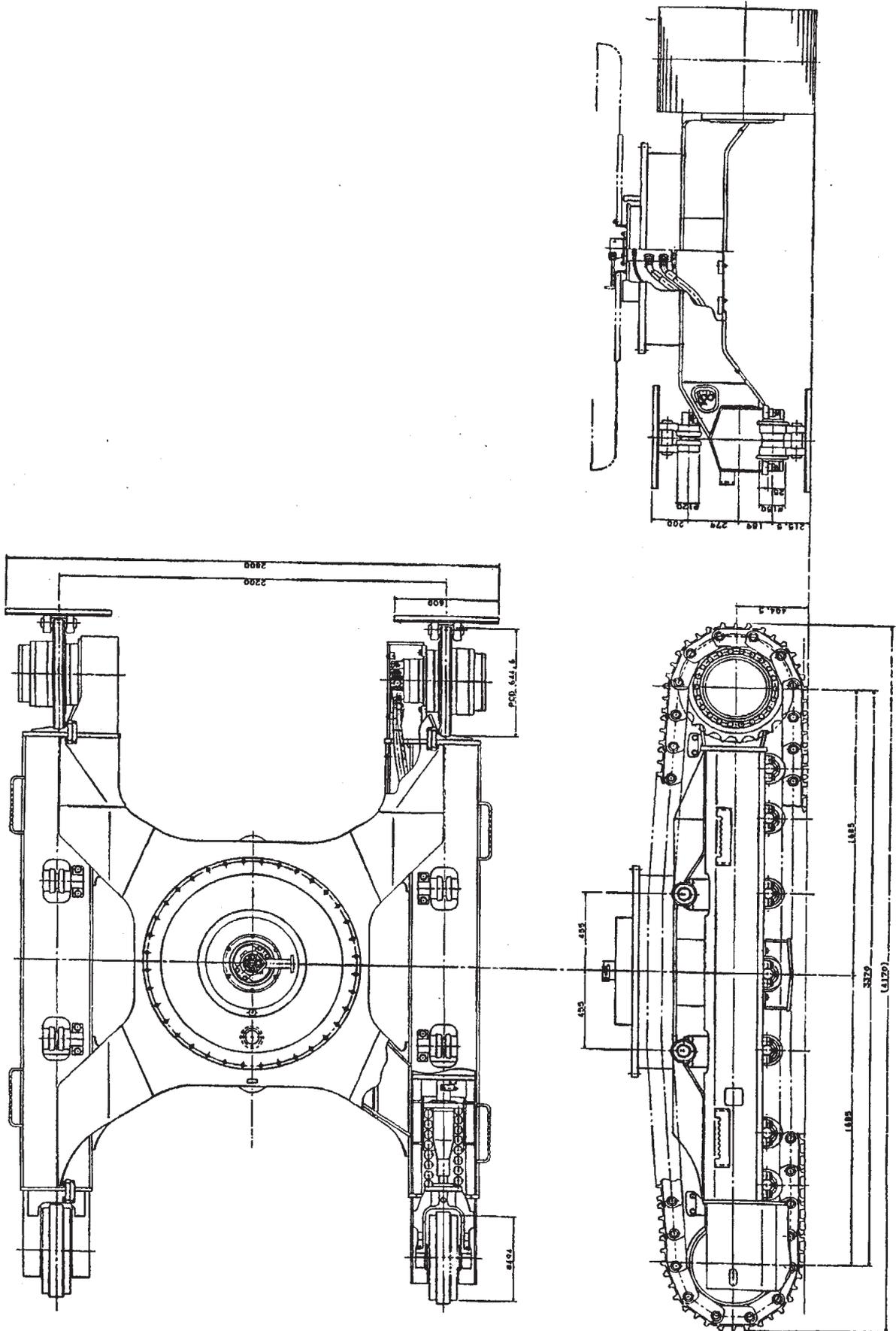
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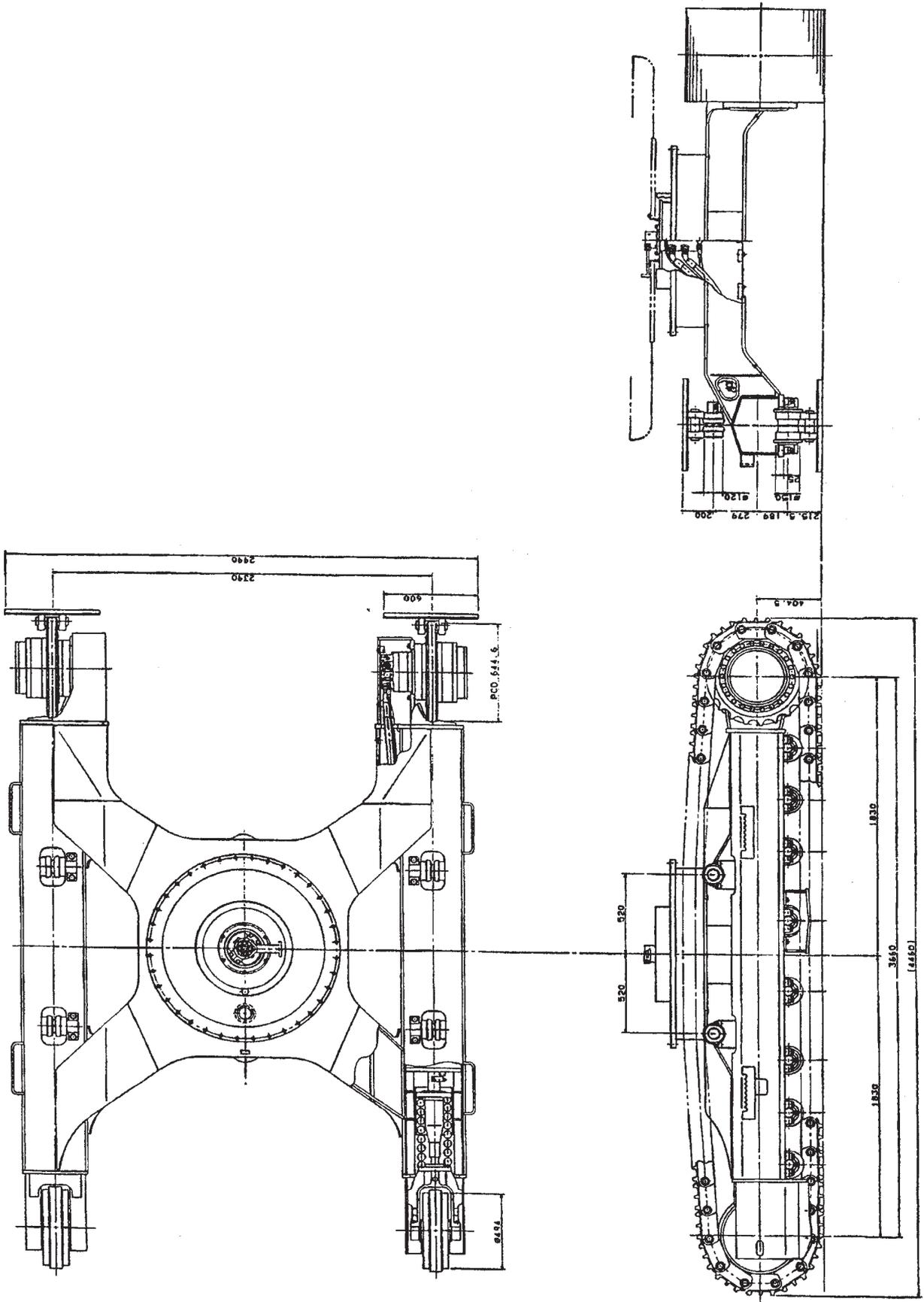
**Torque Specifications JS200/JS240**

<b>Component</b>	<b>Nm</b>	<b>kgfm</b>	<b>lb/ft</b>	<b>Remarks</b>
Counterweight	1059.1-1235.6/1333.7-1549.5	108-126/136-158	780-910.98/983.28-1142.3	Apply 262
Turntable Bearing (Lower Frame)	521.0-608/784-914	53.1-62/79.9-93.2	383.91-448.26/577.67-673.83	Apply 262
Turntable Bearing (Slew Frame)	521.0-608/784-914	53.1-62/79.9-93.2	383.91-448.26/577.67-673.83	Apply 262
Slew Equipment	521.0-608/784-914	53.1-62/79.9-93.2	383.91-448.26/577.67-673.83	Apply 262
Hydraulic Oil Tank	232.3	23.7-29.5	171.35-231.28	Apply 262
Fuel Tank	251.9-	25.7-29.5	185.81-213.28	Apply 262
Cab	127.4	13-14.5	93.99-104.83	Apply 262

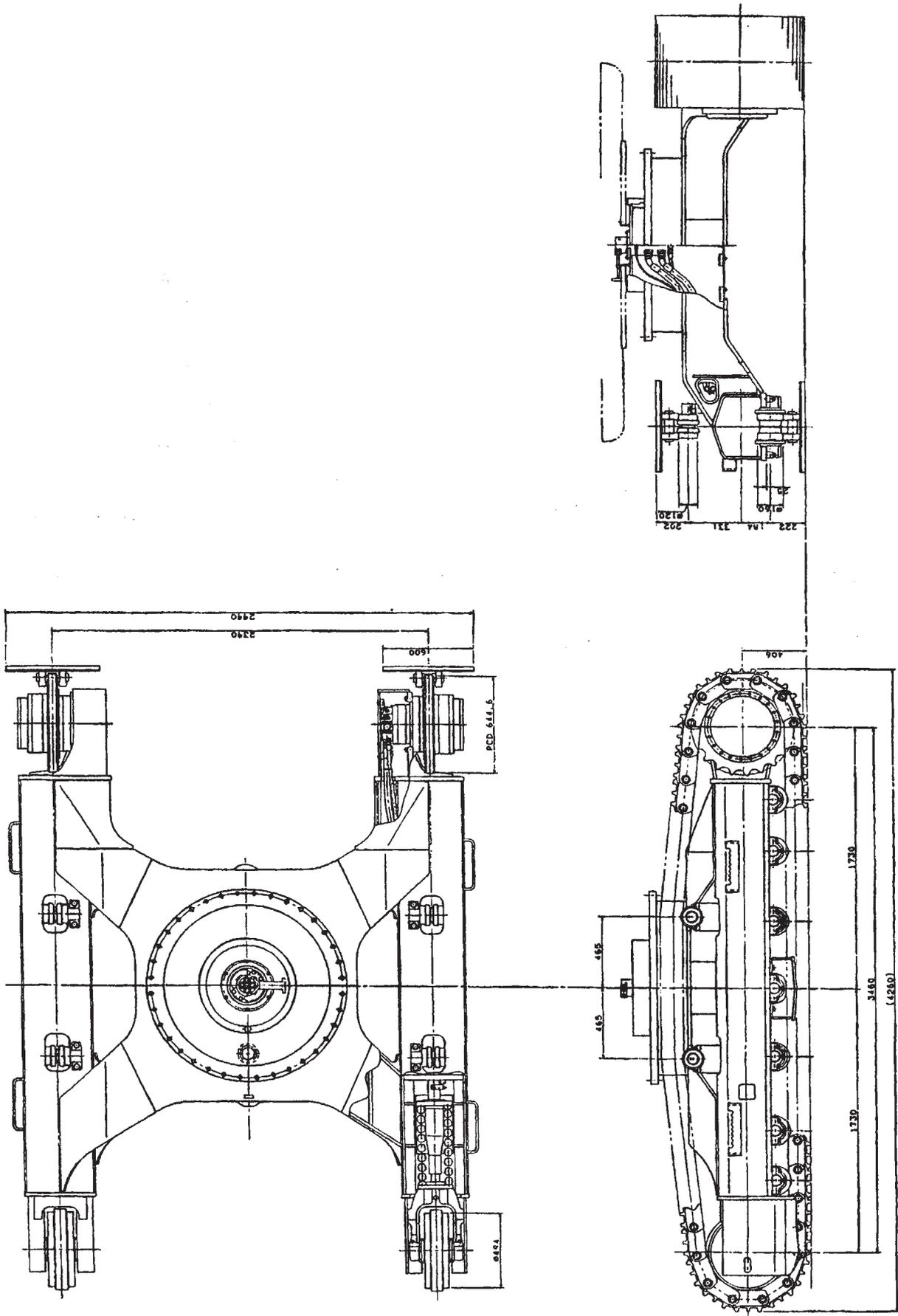
\* Dimensions JS200/JS220



\* Dimensions JS200LC/JS220LC

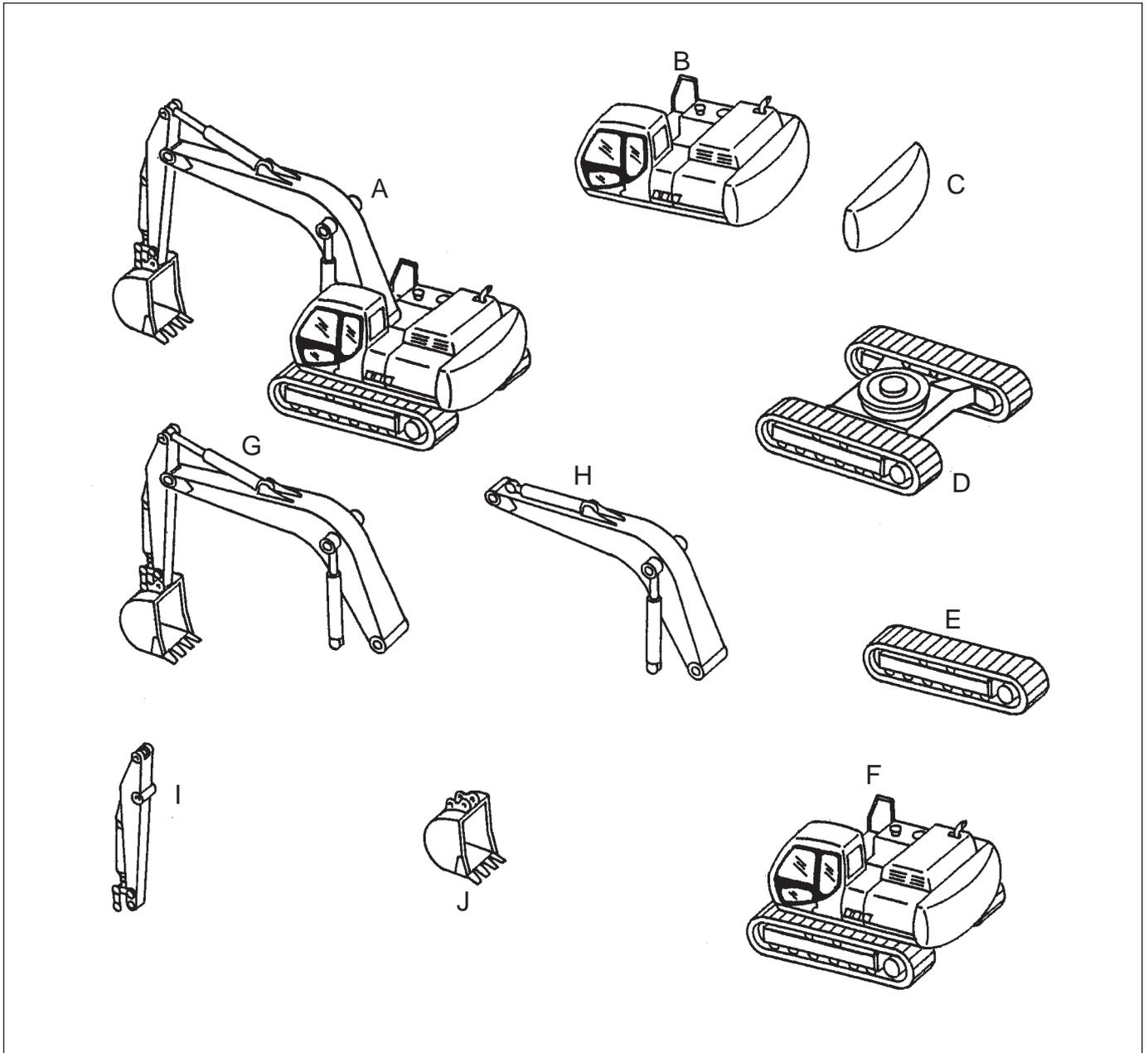


\* Dimensions JS240/JS260





\* Weights JS200, JS200LC, JS220, JS220LC, JS240, JS240LC, JS260, JS260LC



\* **Weights JS200, JS200LC, JS220, JS220LC**

Machine fitted with 3 m boom, 600 mm grouser shoes, 0.7 m<sup>3</sup> bucket (JS200/220), 0.8 m<sup>3</sup> bucket (JS200LC/220LC).

Symbol	Position Name	Weight (kg)			
		JS200	JS200LC	JS220	JS220LC
<b>A</b>	Overall Mass	18700	19100	21475	22155
<b>B</b>	Upper Mechanism Includes counterweight and slew ring bearing	8340	←	9850	←
<b>C</b>	Counterweight	3710	←	5010	←
<b>D</b>	Undercarriage (with grouser shoe)	6650	7080	7823	8503
<b>E</b>	Shoe (600 mm grouser) (one side)	1270	1350	1388	←
<b>F</b>	Machine Main Body	14990	15420	17673	18353
<b>G</b>	Attachment	3659	3706	3802	←
<b>H</b>	Boom (including ram)	2050	←	←	←
<b>I</b>	Dipper (including ram and link)	974	←	←	←
<b>J</b>	Bucket	682	←	←	←

\* **Weights JS240, JS240LC, JS260, JS260LC**

Machine fitted with 3.1 m boom, 600 mm grouser shoes, 0.9 m<sup>3</sup> bucket (JS240/260), 1.0 m<sup>3</sup> bucket (JS240LC/260LC).

Symbol	Position Name	Weight (kg)			
		JS240	JS240LC	JS260	JS260LC
<b>A</b>	Overall Mass	22500	23100	24920	25790
<b>B</b>	Upper Mechanism Includes counterweight and slew ring bearing	9850	←	10785	←
<b>C</b>	Counterweight	4510	←	5500	←
<b>D</b>	Undercarriage (with grouser shoe)	7950	8550	9399	10269
<b>E</b>	Shoe (600 mm grouser) (one side)	1370	1480	1445	←
<b>F</b>	Machine Main Body	17800	18400	20184	21054
<b>G</b>	Attachment	4684	4736	←	←
<b>H</b>	Boom (including ram)	2638	←	←	←
<b>I</b>	Dipper (including ram and link)	1268	←	←	←
<b>J</b>	Bucket	830	←	←	←

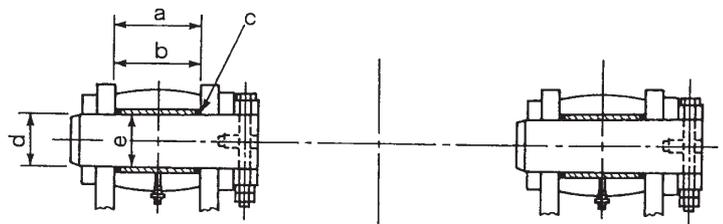
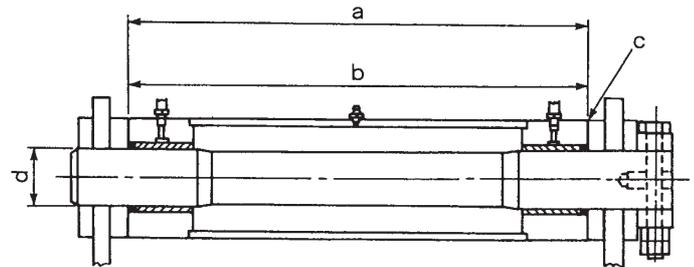
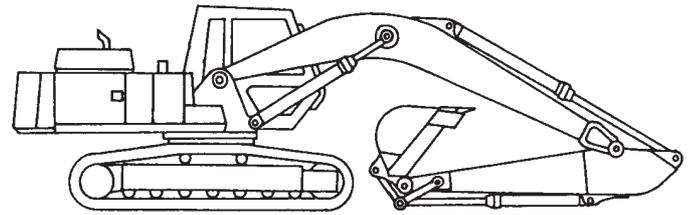
## \* Weights JS200, JS200LC, JS220, JS220LC, JS240, JS240LC, JS260, JS260LC

	Part Name	Dry Weight (kg)			
		JS200/220	JS200LC/220LC	JS240/260	JS240LC/260LC
1	Travel motor	270	←	←	←
2	Drive Sprocket	51	←	←	←
3	Take-up roller	88	←	←	←
4	Upper roller assembly	17	←	←	←
5	Lower roller assembly	37	←	←	←
6	500 mm grouser shoe assembly	1266	1348	1386	1485
7	600 mm grouser shoe assembly	1473	1569	1505	1633
8	700 mm grouser shoe assembly	1601	1706	1636	1775
9	-	-	-	-	-
10	Slew mechanism	194	←	335	←
11	Slew ring	216	←	389	←
12	Counterweight	3710/5010	←	4510/5500	←
13	Engine	490	←	495	←
14	Radiator	106	←	145	←
15	Hydraulic pump	150	←	←	←
16	Fuel Tank	81	←	←	←
17	Sump Tank	127	←	←	←
18	Control valve	166	←	←	←
19	Rotary joint	31	←	←	←
20	Boom	1305	←	1747	←
21	Dipper	613	←	786	←
22	Bucket	682	←	830	←
23	Boom ram	179	←	211	←
24	Dipper ram	277	←	341	←
25	Bucket ram	148	←	215	←

**Attachments**

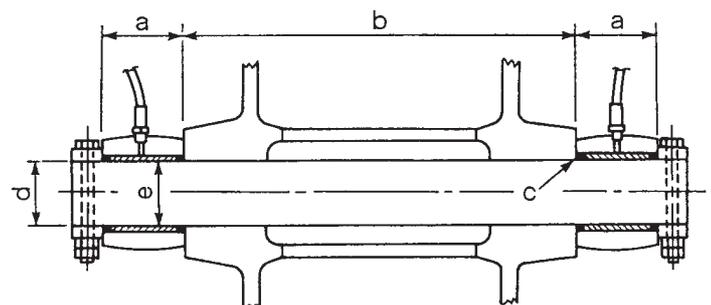
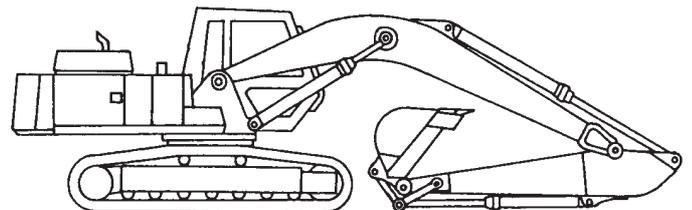
**Boom and Slew Frame Installation JS200, JS200LC**

Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
1. Boom and slew frame installation	Slew frame	a	682	692
	Boom	b	681	679
	Clearance	c	1.0-3.5	Shim for adjustment KRV1180
	Pin	d	ø90	ø89
	Bushing (boom)	e	ø90	ø91.5
* 2. Boom ram and slew frame installation	Slew frame	a	106	112
	Boom ram (dump end)	b	105	103
	Clearance	c	1.0-2.5	Shim for adjustment KRV1197
	Pin	d	ø80	ø79
	Bushing (boom ram)	e	ø80	ø81.5



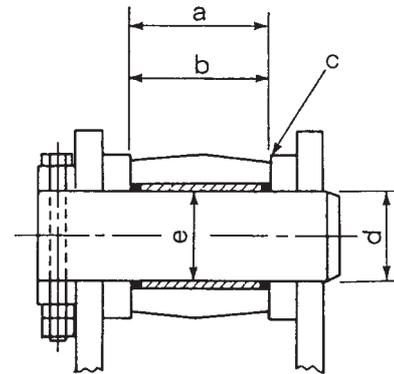
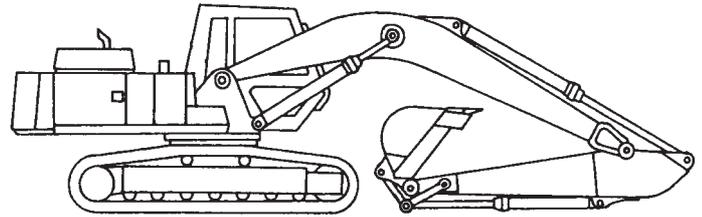
**Boom Ram Installation JS200, JS200LC**

Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
3. Boom and boom ram installation	Boom ram (dump end)	a	100	98
	Boom	b	525	519
	Clearance	c	1.0-2.5	Shim for adjustment KRV1178
	Pin	d	ø85	ø84
	Bushing (boom ram)	e	ø85	ø86.5



**Attachments (continued)****Dipper Ram Installation JS200, JS200LC**

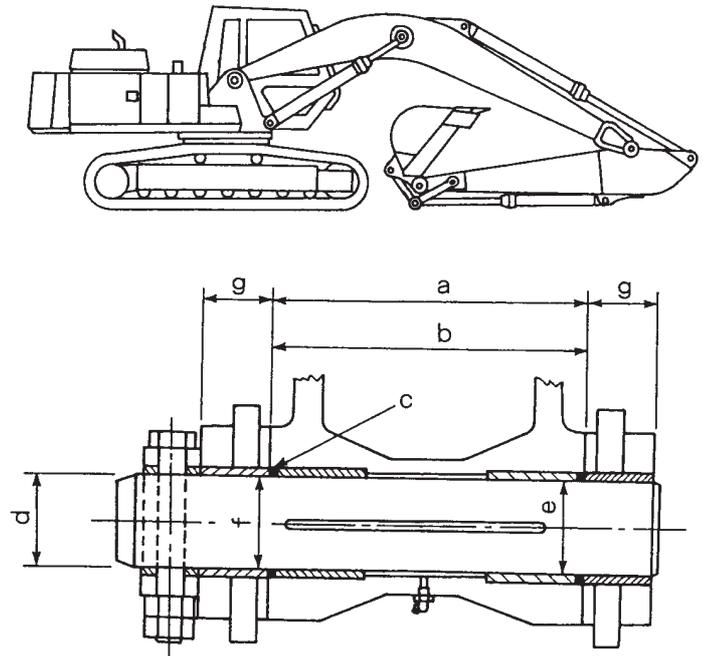
Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
4. Dipper ram installation	Boom	a	121	127
	Dipper ram (dump end)	b	120	118
	Clearance	c	0.5-3.0	Shim for adjustment KRV1197
	Pin	d	ø80	ø79
	Bushing (Dipper ram)	e	ø80	ø81.5



**Attachments (continued)**

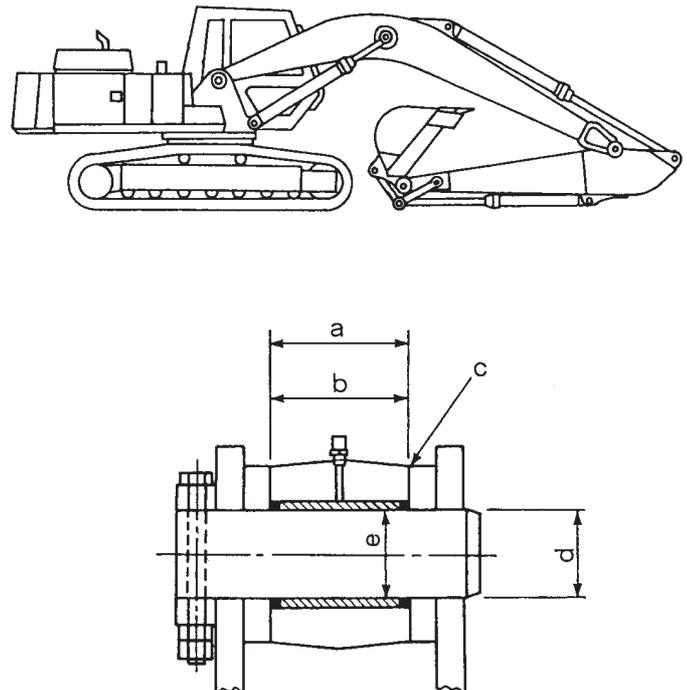
**Dipper Pivot Installation JS200, JS200LC**

Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
5. Dipper Pivot installation	Boom	a	286	289.5
	Dipper	b	285.5	283.5
	Clearance	c	0.5-1.1	Shim for adjustment KRV1180
	Pin	d	ø90	ø89
	Bushing (Dipper)	e	ø90	ø91.5
	Bushing (boom)	f	ø90	ø91.5
	Boom	g	ø80	78



**Dipper and Dipper Ram Installation JS200, JS200LC**

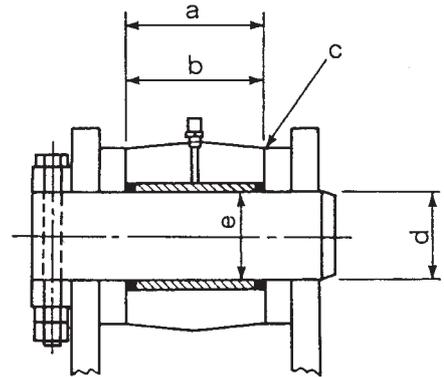
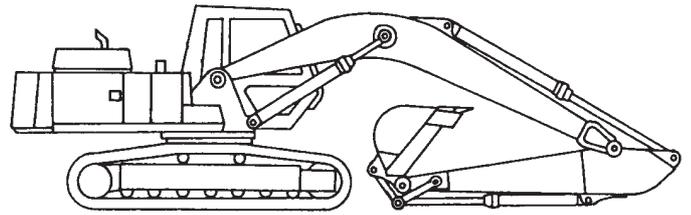
Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
6. Dipper and Dipper ram installation	Boom	a	121	127
	Dipper ram (eye end)	b	120	118
	Clearance	c	0.5-3.0	Shim for adjustment KRP1349
	Pin	d	ø80	ø79
	Bushing (Dipper ram)	e	ø80	ø81.5



**Attachments (continued)**

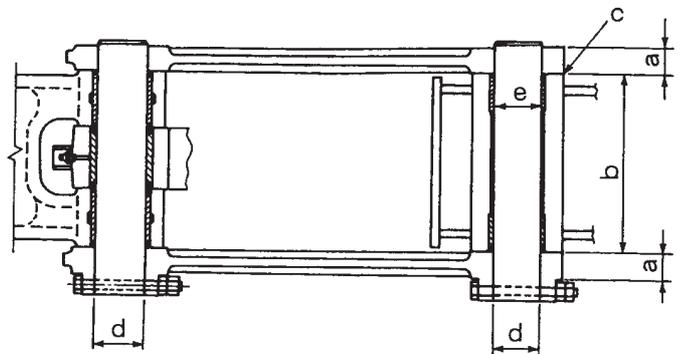
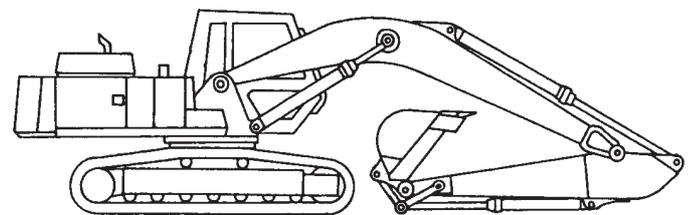
**Bucket Ram Installations JS200, JS200LC**

Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
7. Bucket Ram installation	Dipper	a	101	107
	Bucket ram (eye end)	b	100	98
	Clearance	c	0.5-3.0	Shim for adjustment KRV1176
	Pin	d	ø75	ø74
	Bushing (bucket ram)	e	ø75	ø76.5



**Dipper and Dipper Link Installation JS200, JS200LC**

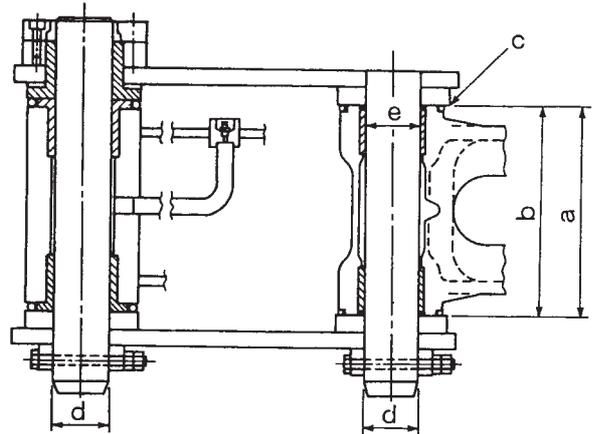
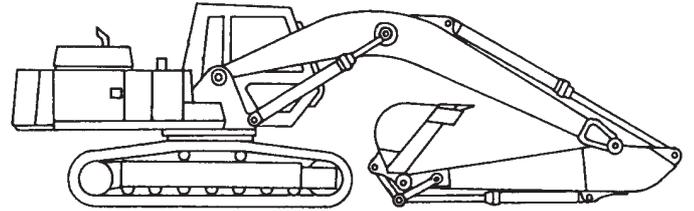
Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
8. Dipper and Dipper link installation	Dipper Link	a	46	43
	Dipper	b	280	278
	Clearance	c	1.0-1.5	Shim for adjustment KHV0169
	Pin	d	ø75	ø74
	Bushing (Dipper)	e	ø75	ø76.5



**Attachments (continued)**

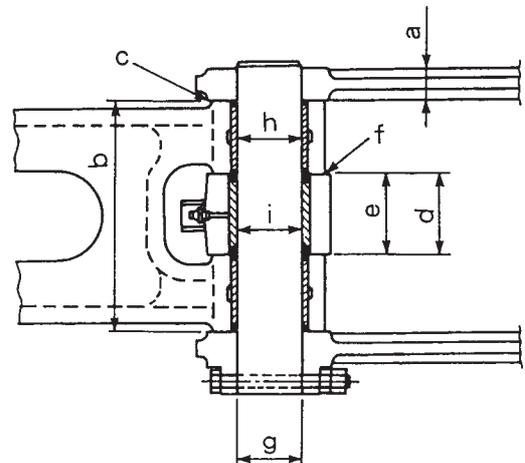
**Bucket and Bucket Link Installation JS200, JS200LC**

Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
9. Bucket and bucket link installation	Bucket	a	307	313
	Bucket link	b	306	304
	Clearance	c	1.0-3.5	Shim for adjustment KRV1197
	Pin	d	ø80	ø79
	Bushing (bucket link)	e	ø80	ø81.5



**Bucket Link and Bucket Ram Installation JS200, JS200LC**

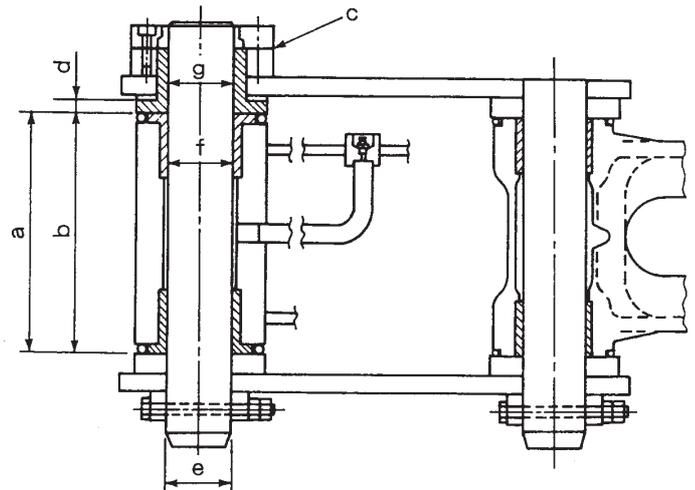
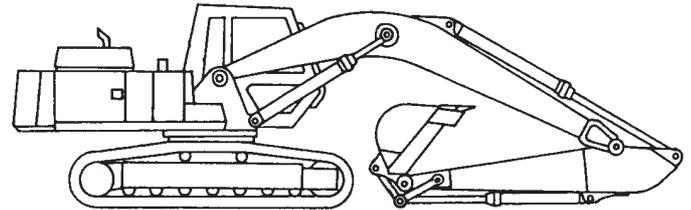
Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
10. Bucket link and bucket ram installation	Dipper Link	a	46	43
	Bucket link	b	280	278
	Clearance	c	1.0-1.5	Shim for adjustment KHV0170
	Bucket link	d	96	98
	Bucket ram (eye end)	e	95	93
	Clearance	f	1.0-2.0	Shim for adjustment KHV0170
	Pin	g	ø85	ø84
	Bushing (Bucket link)	h	ø85	ø86.5
	Bushing (Bucket ram)	i	ø85	ø86.5



**Attachments (continued)**

**Bucket and Dipper Installation JS200, JS200LC**

Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
11. Bucket and dipper installation	Bucket	a	307	313
	Dipper	b	306	304
	Clearance	c	1.0-3.5	Shim for adjustment KRV1159
	Bushing (bucket)	d	16	8
	Pin	e	ø80	ø79
	Bushing (bucket)	f	ø80	ø81.5
	Bushing (bucket)	g	ø80	ø81.5



**Attachments (continued)**

**Shim Adjustment Table**

(Unit: mm)

Pin Diameter	Shim Thickness	Shim Outer Diameter									
		90	100	110	120	130	135	140	145	150	160
60	1.2										
65	1.2		KNV0538		BHV1034						
70	1.2			KNV0696		KNV0539					
75	1.2					KRV1176		KHV0169			KNV0534
80	1.2							KRV1197		KRP1349	
85	1.2					KRV1178				KHV0170	
90	1.2							KBV0837			KSP0268
95	1.2									KNV0468	
100	1.2										
105	1.2										
110	1.2										
115	1.2										
120	1.2										
125	1.2										
130	1.2										

**Attachments (continued)**

**Shim Adjustment Table (continued)**

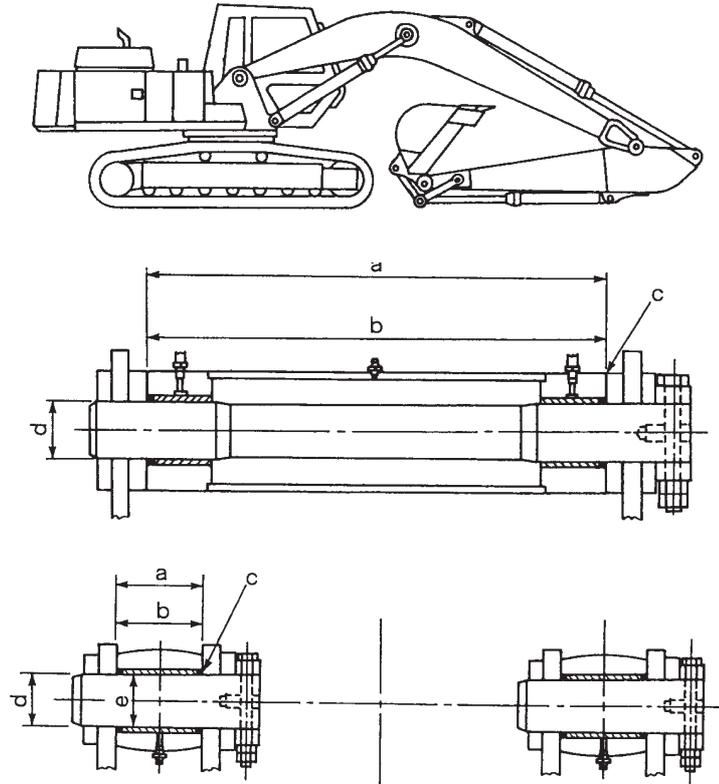
(Unit: mm)

Pin Diameter	Shim Outer Diameter										
	165	170	180	185	190	200	210	220	230	240	250
60											
65											
70											
75											
80											
85											
90	KBV0764				KRV1180						
95											
100								KBV0474			
105											
110											
115											
120			KRV1159								
125											
130					KBV0713						

**Attachments (continued)**

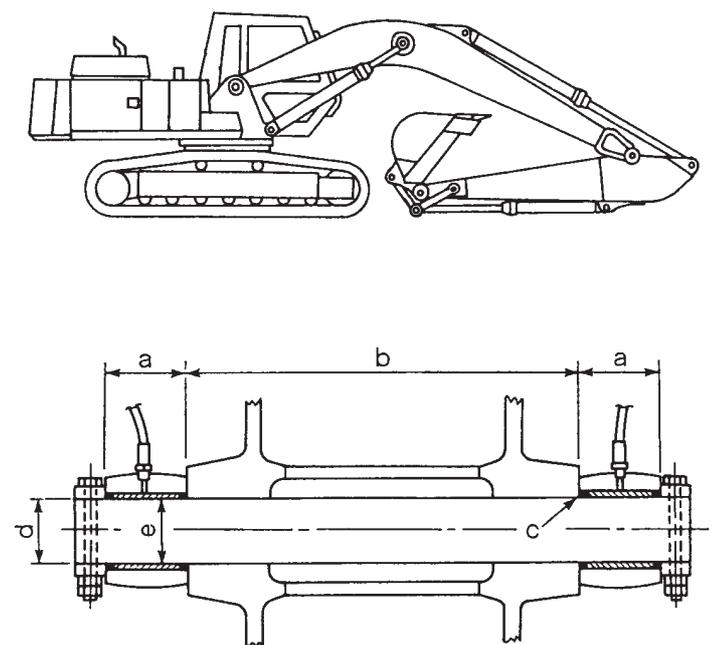
**Boom and Slew Frame Installation JS240, JS240LC**

Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
1. Boom and slew frame installation	Slew frame	a	676	686
	Boom	b	-	-
	Clearance	c	1.0-3.5	Shim for adjustment KBV0474
	Pin	d	ø100	ø99
	Bushing (boom)	e	ø100	ø101.5
2. Boom and slew frame installation	Slew frame	a	109	115
	Boom ram (dump end)	b	108	106
	Clearance	c	1.0-2.5	Shim for adjustment KBV0764
	Pin	d	ø90	ø89
	Bushing (boom ram)	e	ø80	ø91.5



**Boom Ram Installation JS240, JS240LC**

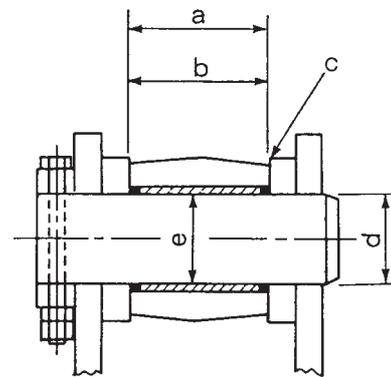
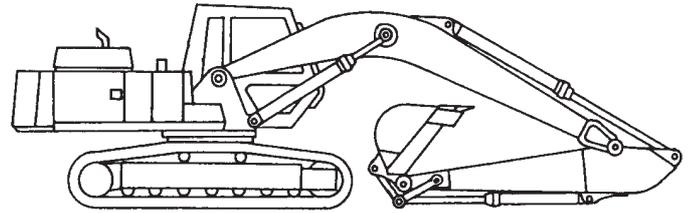
Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
3. Boom and boom ram installation	Boom ram (dump end)	a	108	106
	Boom	b	508	502
	Clearance	c	1.0-2.5	Shim for adjustment KBV0837
	Pin	d	ø90	ø89
	Bushing (boom ram)	e	ø90	ø91.5



**Attachments (continued)**

**Dipper Ram Installation JS240, JS240LC**

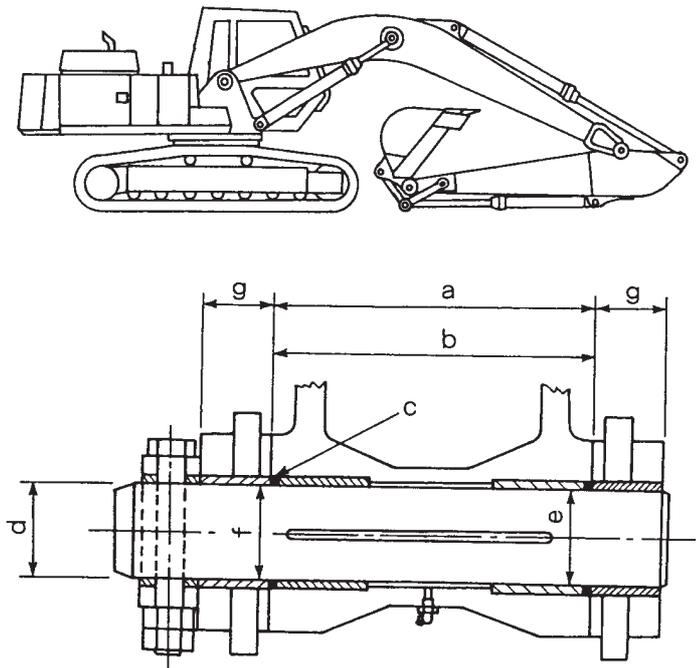
Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
4. Dipper Ram installation	Boom	a	121	127
	Dipper ram (dump end)	b	120	118
	Clearance	c	0.5-3.0	Shim for adjustment KBV0764
	Pin	d	ø90	ø89
	Bushing (Dipper ram)	e	ø90	ø91.5



**Attachments (continued)**

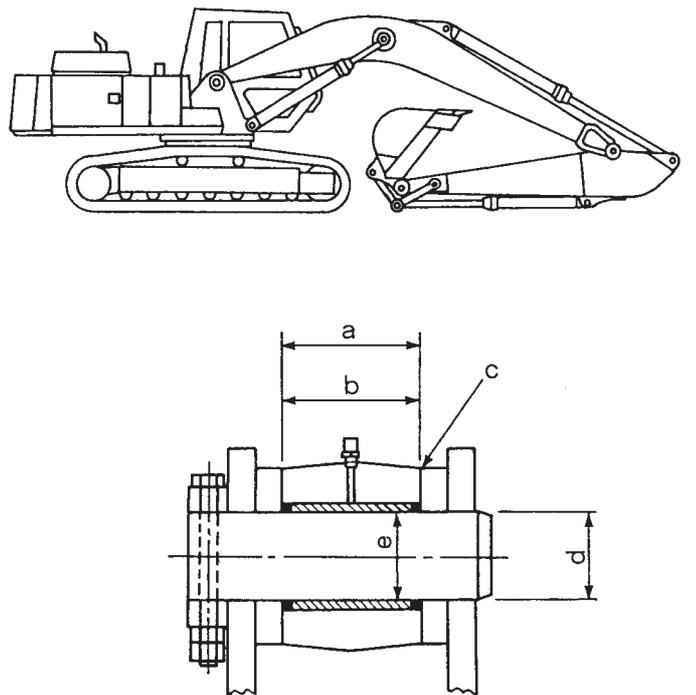
**Dipper Pivot Installation JS240, JS240LC**

Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
5. Dipper Pivot installation	Boom	a	286	289.5
	Dipper	b	285.5	283.5
	Clearance	c	0.5-1.1	Shim for adjustment KBV0000
	Pin	d	∅100	∅99
	Bushing (Dipper)	e	∅100	∅101.5
	Bushing (boom)	f	∅100	∅101.5
	Boom	g	82	80



**Dipper and Dipper Ram Installation JS240, JS220LC**

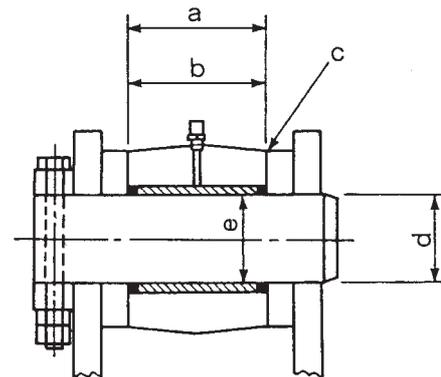
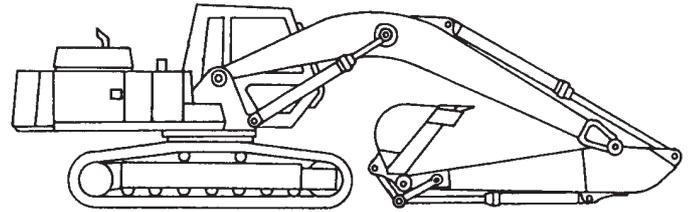
Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
6. Dipper and Dipper ram installation	Boom	a	121	127
	Dipper ram (eye end)	b	120	118
	Clearance	c	0.5-3.0	Shim for adjustment KRV1180
	Pin	d	∅90	∅99
	Bushing (Dipper ram)	e	∅90	∅91.5



**Attachments (continued)**

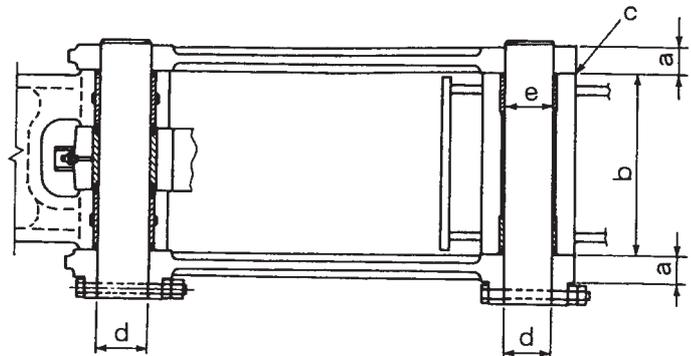
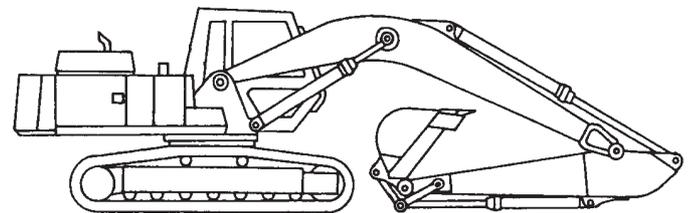
**Bucket Ram Installations JS240, JS240LC**

Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
7. Bucket ram installation	Dipper	a	116	122
	Bucket ram (eye end)	b	115	113
	Clearance	c	0.5-3.0	Shim for adjustment KRV1197
	Pin	d	ø80	ø79
	Bushing (bucket ram)	e	ø80	ø81.5



**Dipper and Dipper Link Installation JS240, JS240LC**

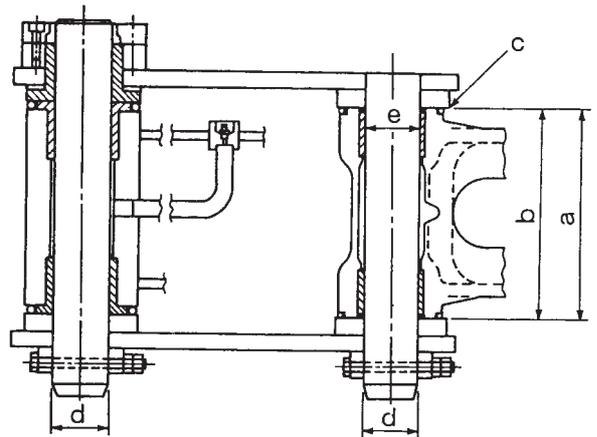
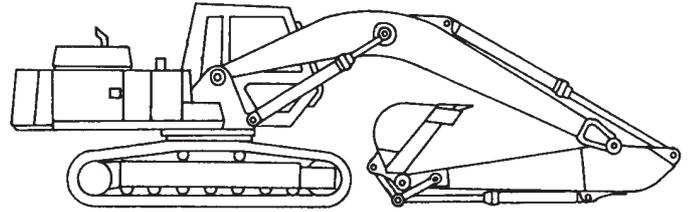
Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
8. Dipper and Dipper link installation	Dipper Link	a	50	47
	Dipper	b	296	294
	Clearance	c	1.0-1.5	Shim for adjustment KRP1349
	Pin	d	ø80	ø79
	Bushing (Dipper)	e	ø80	ø81.5



**Attachments (continued)**

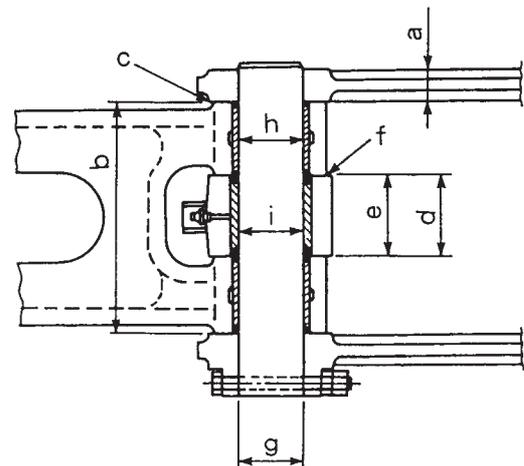
**Bucket and Bucket Link Installation JS240, JS240LC**

Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
9. Bucket and bucket link installation	Bucket	a	326	323
	Bucket link	b	325	323
	Clearance	c	1.0-3.5	Shim for adjustment KRV1180
	Pin	d	ø90	ø89
	Bushing (bucket link)	e	ø90	ø91.5



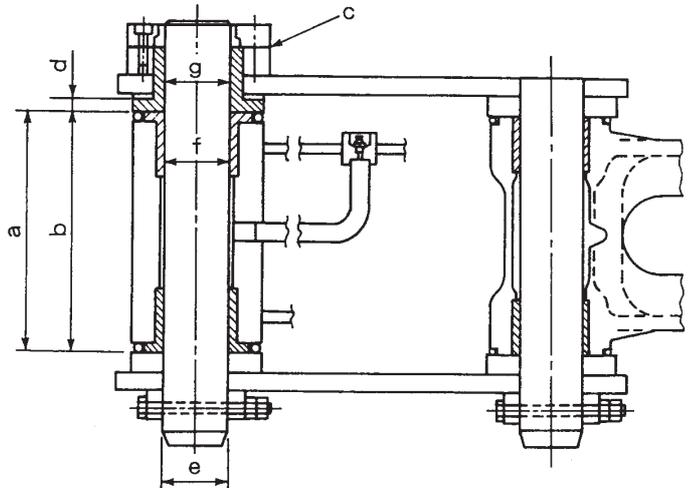
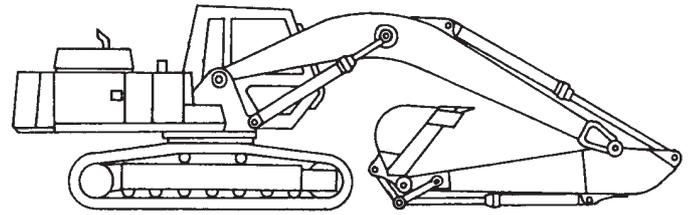
**Bucket Link and Bucket Ram Installation JS240, JS240LC**

Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
10. Bucket link and bucket ram installation	Dipper Link	a	50	47
	Bucket link	b	296	294
	Clearance	c	1.0-1.5	Shim for adjustment KSP0268
	Bucket link	d	106	108
	Bucket ram (eye end)	e	105	103
	Clearance	f	1.0-2.0	Shim for adjustment KSP0268
	Pin	g	ø90	ø89
	Bushing (Bucket link)	h	ø90	ø91.5
	Bushing (Bucket ram)	i	ø90	ø91.5



**Attachments (continued)****Bucket and Dipper Installation JS240,  
JS240LC**

Equipment Name	Part Name	Code	Standard Value (mm)	Service Limit (mm)
11. Bucket and Dipper installation	Bucket	a	326	323
	Dipper	b	325	323
	Clearance	c	1.0-3.5	Shim for adjustment KBV0713
	Bushing (bucket)	d	16	8
	Pin	e	ø90	ø89
	Bushing (bucket)	f	ø90	ø91.5
	Bushing (bucket)	g	ø90	ø91.5



**Attachments (continued)**

**Shim Adjustment Table**

(Unit: mm)

Pin Diameter	Shim Thickness	Shim Outer Diameter									
		90	100	110	120	130	135	140	145	150	160
60	1.2										
65	1.2		KNV0538		BHV1034						
70	1.2			KNV0696		KNV0539					
75	1.2					KRV1176		KHV0169			KNV0534
80	1.2							KRV1197		KRP1349	
85	1.2					KRV1178				KHV0170	
90	1.2							KBV0837			KSP0268
95	1.2									KNV0468	
100	1.2										
105	1.2										
110	1.2										
115	1.2										
120	1.2										
125	1.2										
130	1.2										

**Attachments (continued)**

**Shim Adjustment Table (continued)**

(Unit: mm)

Pin Diameter	Shim Outer Diameter										
	165	170	180	185	190	200	210	220	230	240	250
60											
65											
70											
75											
80											
85											
90	KBV0764				KRV1180						
95											
100								KBV0474			
105											
110											
115											
120			KRV1159								
125											
130					KBV0713						

## Direct Glazing

The following procedures explain how to correctly remove and install panes of glass that are directly bonded to the cab frame apertures. When carrying out the procedures, relevant safety precautions must be taken.

- 1 Always wear safety glasses during both removal and replacement.
- 2 Use protective gloves - heavy duty leather gauntlet type gloves when cutting out the broken glass; 'non-slip' type gloves when handling/moving panes of glass; surgical type gloves when using the polyurethane adhesives.
- 3 Wear protective overalls.
- 4 DO NOT smoke - the activators and primers used in the procedures are highly flammable.
- 5 Do not attempt to handle or move panes of glass unless you are using glass lifters (see **Service Tools**, Section 1).

Several special tools are required to successfully complete the removal and replacement procedures. Reference is made to the tools in the text. The majority of these tools can be obtained locally and the remainder from JCB Service (see **Service Tools**, Section 1).

The work must only be carried out in a dry, frost free environment. A protective canopy may be required or the machine/frame must be moved to a sheltered area. In damp or wet conditions, hinged doors and window frames can be removed from the machine and taken to a more suitable (dry) environment.

Glass should not be replaced at temperatures below 5°C (41°F).

### Removing the Broken Glass and Old Sealant

#### **WARNING**

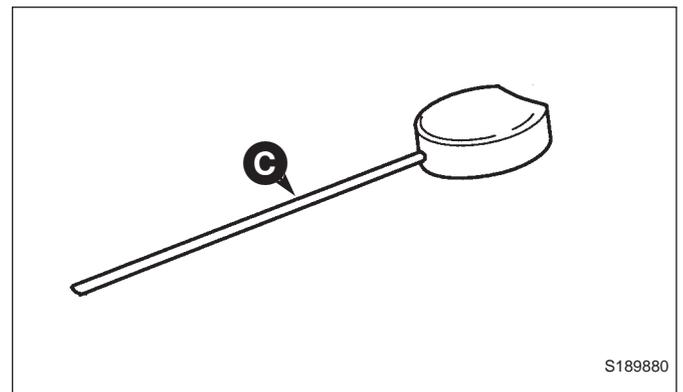
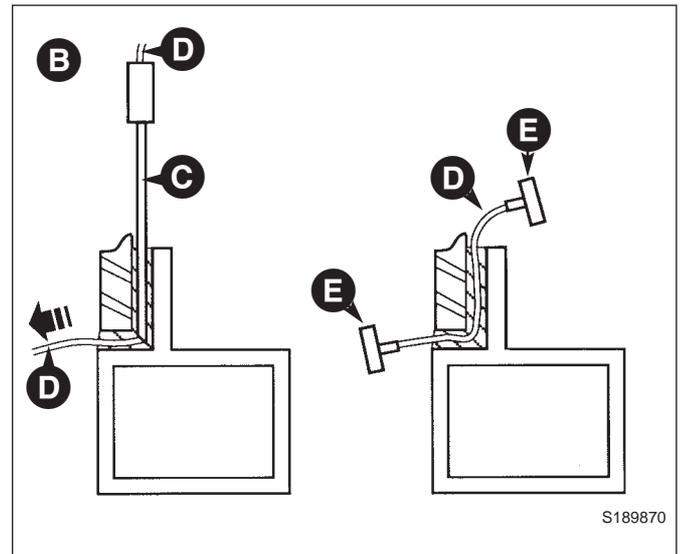
**Always wear safety glasses when removing or installing screen glass. Never use a power operated knife when removing the sealant around a toughened glass screen. The action of the knife could cause particles of glass to be thrown with sufficient force to cause serious injury, even when safety glasses are being worn. Use only hand operated tools when working with toughened glass.**

BF 2-3/1

## Direct Glazing (cont'd)

### Removing the Broken Glass and Old Sealant (cont'd)

- 1 Position the machine on level ground and apply the parking brake. Stop the engine. Put protective covers over the cab seat and control pedestals.
- 2 Toughened glass - remove as much of the shattered glass as possible prior to cutting out the old sealant.
- 3 Cut out the old sealant, leaving approximately 1 to 2 mm on the cab frame. There are several tools and techniques for doing this:
  - a Braided Cutting Wire and Handles **B**. This method uses a 3-core wire, a wire starter tube and two handles (see **Service Tools**, Section 1).
    - (i) Insert the steel tube **C** into the old sealant on the inside of the glass.
    - (ii) Insert the braided cutting wire **D** down the centre of the steel tube. If necessary, from the outside, cut out local sealant at the point of the tube to gain access to the wire.
    - (iii) Using suitable pliers, pull the cutting wire through the sealant to the outer side of the glass.
    - (iv) Secure each end of the braided cutting wire in the special handles **E**.
    - (v) Move the cutting wire backwards and forwards in a sawing motion and at the same time gently push or pull the wire to cut through the old sealant.



## Direct Glazing (cont'd)

### Removing the Broken Glass and Old Sealant (cont'd)

**b** Cut-out Knife **F**. The cut-out knife can be used as a left handed or right handed tool. For the knife and its replaceable blades, refer to **Service Tools**, Section 1.

- (i) Insert the knife blade into the sealant.
- (ii) Make sure that the blade of the knife is against the glass as shown at **G**.
- (iii) Use the 'pull-handle' to pull the knife along and cut out the old sealant.

**c** Craft Knife **H**. The blades are replaceable.

- (i) Insert the knife blade into the sealant.
- (ii) Pull the knife along and cut out the old sealant.

**Note:** There are other tools available to cut out the old sealant. For example, there is a long handle type craft knife to give extended reach. Refer to **Service Tools**, Section 1, for details of this and any other tools.

**4** Toughened glass - remove the cut off sealant and all remaining particles of shattered glass.

**5** If necessary, trim off the remaining old sealant to leave approximately 1 to 2 mm on the upright face of the cab frame aperture, as shown at **J**.

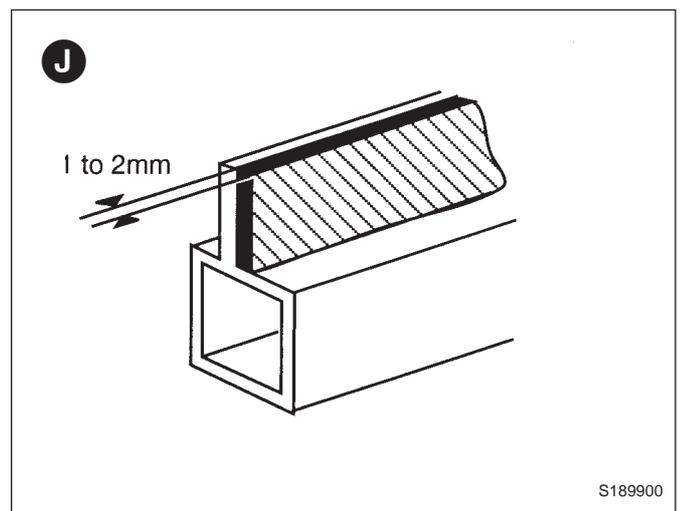
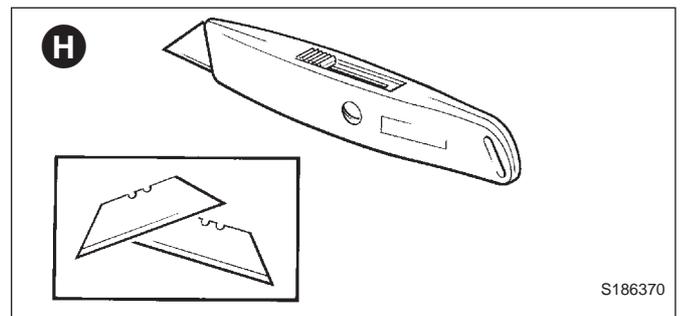
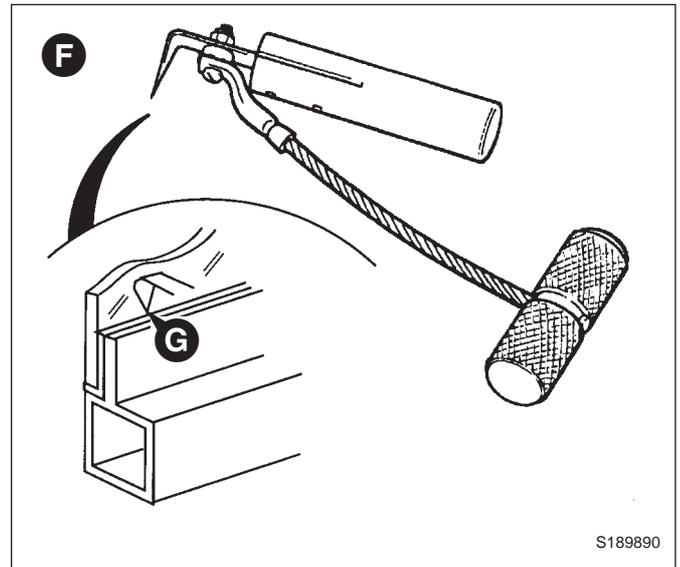
**6** Apply a coat of 'Black Primer 206J' to the paintwork if:

- a** Paintwork was damaged or scratched during the glass/sealant removal procedures.
- b** The old sealant was inadvertently cut back to the cab frame during the glass/sealant removal procedures.

### Preparing the Cab Frame Aperture

- 1** If damp or wet, dry the aperture area using a hot air gun (sourced locally).
- 2** Use 'Active Wipe 205' to thoroughly clean and 'prime' the trimmed sealant. Use a lint free cloth to apply the 'Active Wipe 205', allow 5 minutes flash off (drying) time.

**Note:** Do not use any other type of cleaning fluids, otherwise they may be absorbed into the old sealant and ultimately prevent the new glass from bonding.



## Direct Glazing (cont'd)

### Preparing the New Glass

- 1 Make sure that the new glass correctly fits the frame aperture **K**.
  - a Put two spacer blocks **L** onto the bottom part of the frame aperture.
  - b Install the new glass on the spacer blocks - ALWAYS USE GLASS LIFTERS **M** (see **Service Tools**, Section 1). Check that there is an equal sized gap all round the edge of the glass.

**Note:** The spacer blocks are rectangular in section to give two common gap widths. If necessary they can be trimmed to a smaller size to give an equal sized gap around the glass.

**IMPORTANT:** The glass edges MUST NOT touch the frame, otherwise movement of the frame will chip and eventually break the newly installed glass.

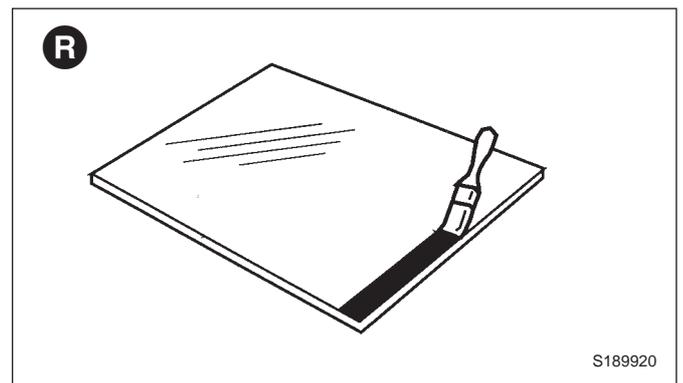
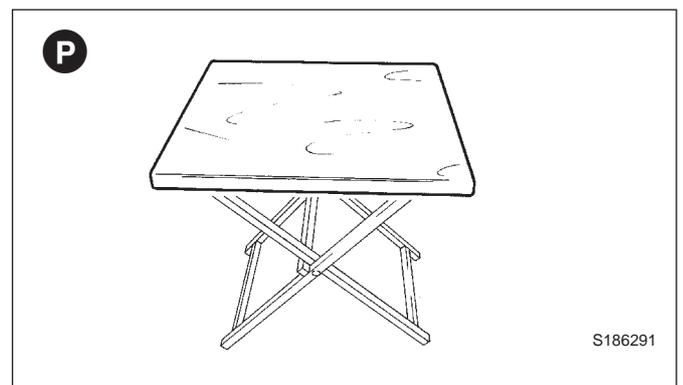
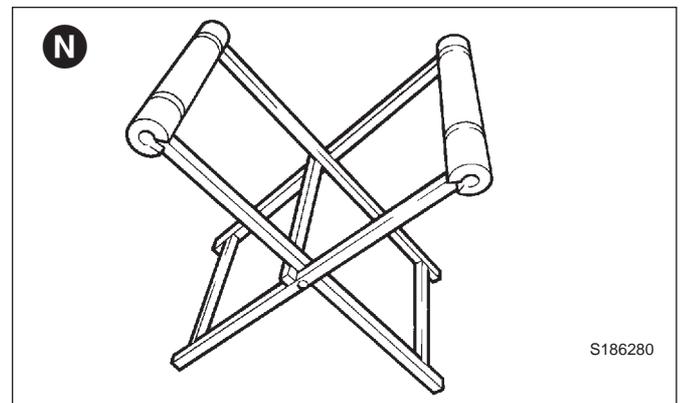
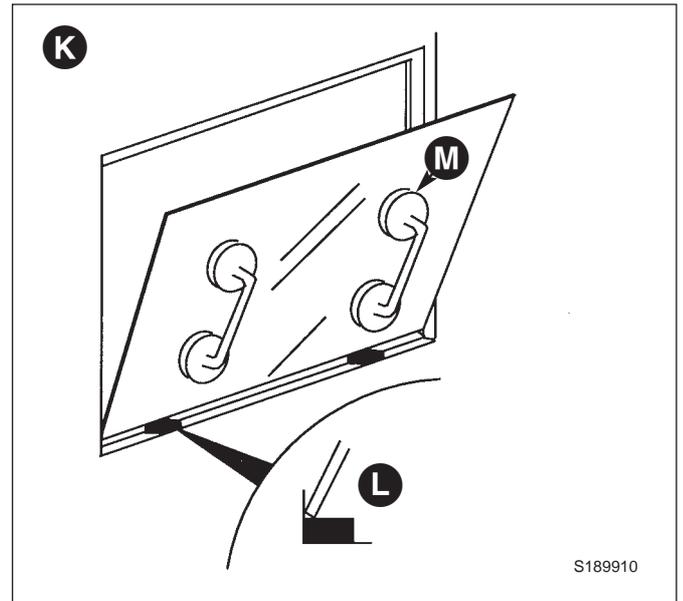
- 2 After checking for size, remove the new glass and place it on a purpose made glass stand **N** (see **Service Tools**, Section 1).

Small panes of glass will need locating on a 600 x 700 mm x 15 to 19 mm thick plywood board **P** (sourced locally to fit the glass stand **N**). It is recommended that an access hole is cut in the board to accommodate the glass lifter, making it easier and safer to handle small panes of glass. The board should be covered with felt or carpet to give an anti-scratch surface. Resting the glass on four spacer blocks will ensure clearance of the cartridge nozzle tip during application of the polyurethane sealant.

- 3 Make sure the glass is positioned on the stand the correct way up (i.e. with the black ceramic ink band upwards) ready for application of primer etc.
- 4 a Use 'Active Wipe 205' to thoroughly clean and 'prime' the black ceramic ink band printed on the glass (see **Note 1**). Use a lint free cloth to apply the 'Active Wipe 205', allow 5 minutes flash off (drying) time.

**Note 1:** Do not touch the glass after cleaning with the 'Active Wipe 205'.

- b If the glass does not have a black ceramic ink band, paint a band on the glass using 'Black Primer 206J'. The band should be approximately 25mm (1in) wide, and the edge should be a neat straight line as shown at **R**.



## Direct Glazing (cont'd)

### Preparing the New Glass (cont'd)

- 5 Install the Ultra Fast Adhesive cartridge (see **Sealing and Retaining Compounds**, Section 1 and **Note 2** below) into a suitable applicator gun:
  - a Remove the aluminium disc cover from the base of the cartridge and discard the 'desiccant capsule'.
  - b Make sure that the rolled edge of the cartridge is not damaged - if necessary, the edges should be pressed flat, otherwise it will be difficult to remove the cartridge from the applicator gun.
  - c Pierce the front 'nozzle' end of the cartridge to its maximum diameter.
  - d Fit the pre-cut nozzle shown at **S**.
  - e Install the cartridge in the applicator gun.

**Note 2:** Cold material will be very difficult to extrude. The cartridges must be pre-heated in a special oven (see **Service Tools**) for 1 hour to a temperature of 80°C (176°F). Pre-heating the cartridges makes the adhesive more workable and also brings the 'curing' time down to 30 minutes.

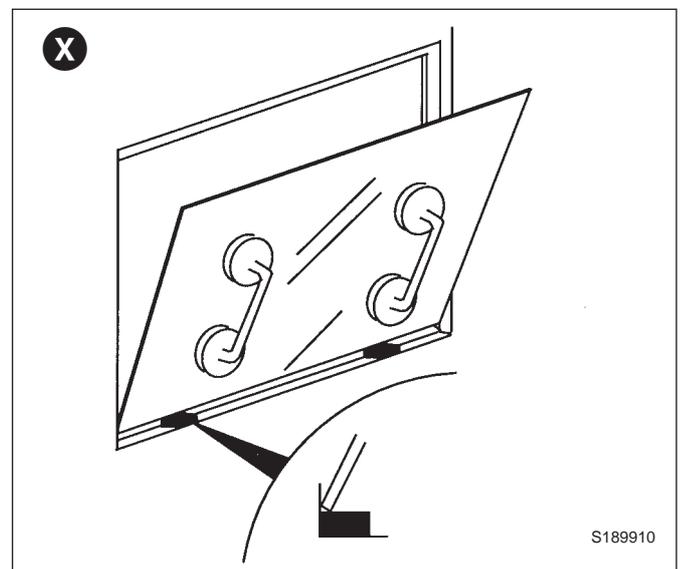
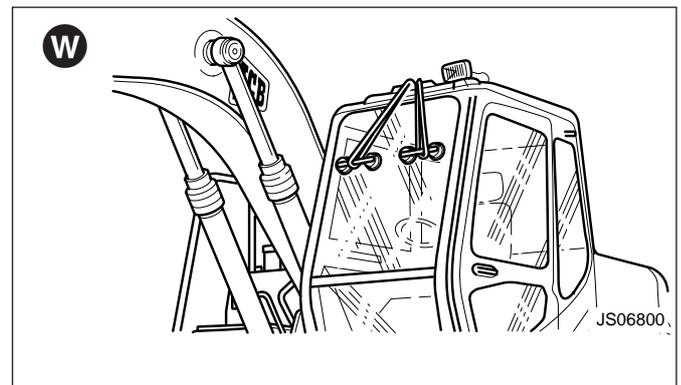
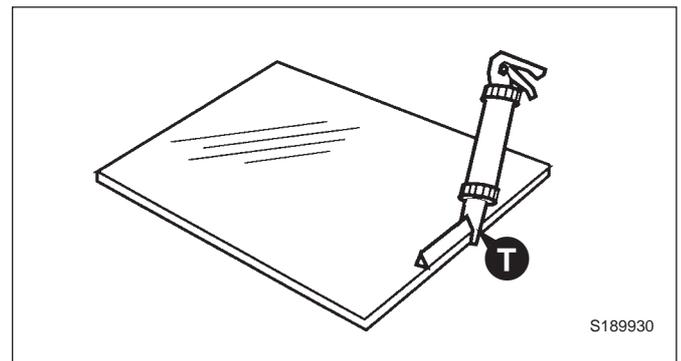
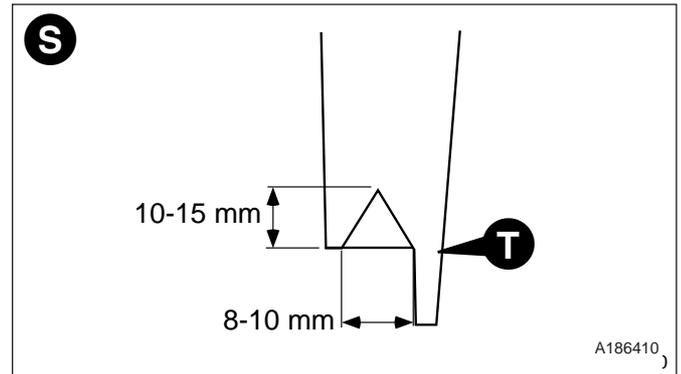
- 6 Apply the pre-heated adhesive to the glass (do not start in a corner). Keep the nozzle guide **T** against the edge of the glass and make sure that the adhesive forms a continuous 'pyramid' shape.

**Note 3:** Once the pre-heated adhesive has been applied to the glass, install the glass in the aperture as soon as possible. After approximately 10 minutes the sealant will form a 'skin', this will prevent the glass from bonding.

- 7 After applying the adhesive, leave a small amount of sealant protruding from the nozzle. This will prevent any adhesive left in the cartridge from 'curing'.

### Installing the New Glass

- 1 If the internal trim strip is damaged, renew it (cut to length as required) before fitting the new glass. Make sure the two spacer blocks are in position (see step 1 of **Preparing the New Glass**).
- 2 Install the glass in the frame aperture:
  - a ALWAYS use the special lifting tools when moving the glass. Use a lifting strap to hold large panes of glass in position as shown **W**.
  - b Sit the bottom edge of the glass on the spacer blocks as shown **X**.
  - c Make sure that the glass is correctly positioned, then gently press around the edges of the glass and ensure full adhesive contact is achieved. Do not press too hard or too much adhesive will squeeze



## Direct Glazing (cont'd)

### Installing the New Glass (cont'd)

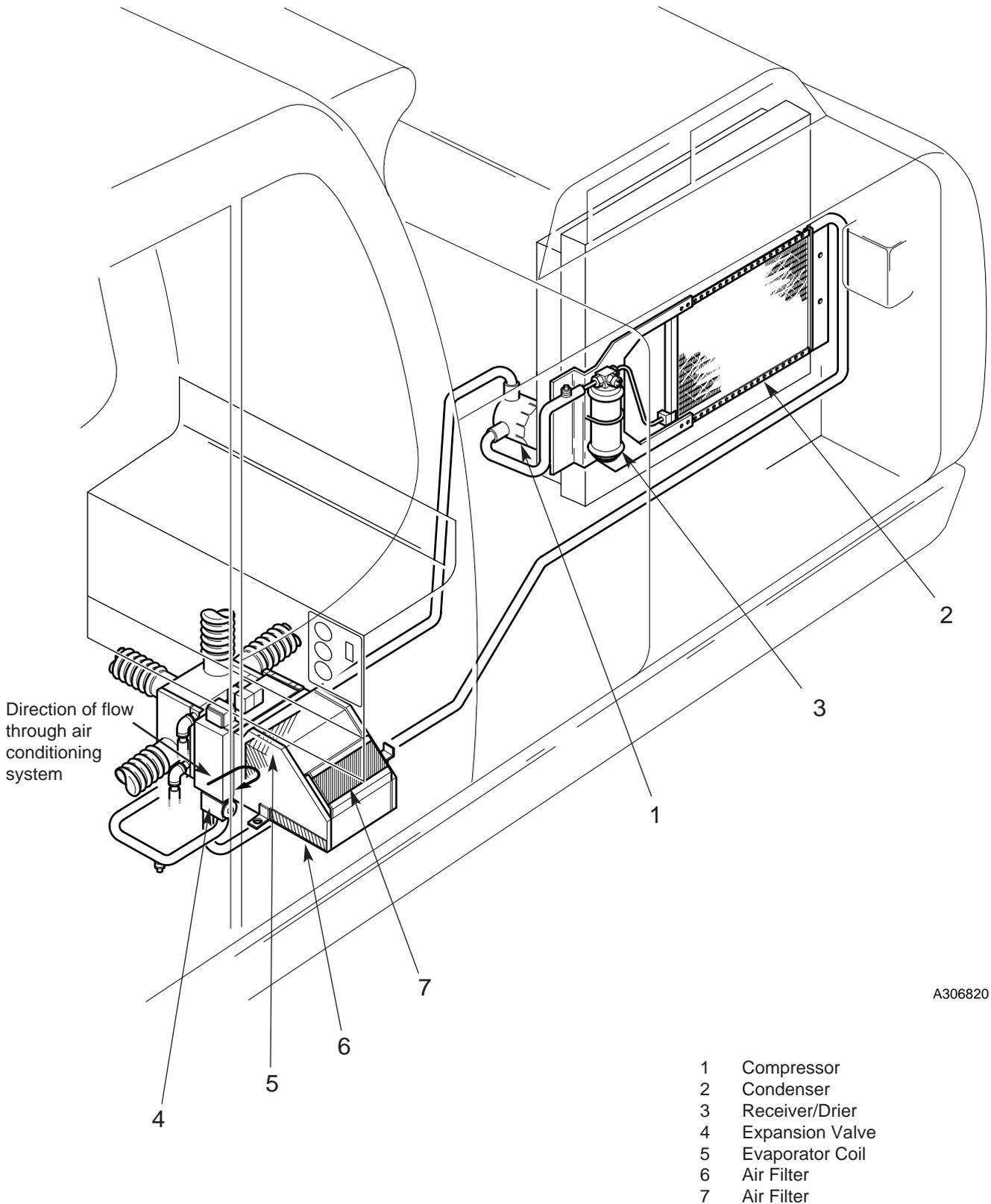
- 3 Make the inside seal smooth:
  - a Wearing surgical gloves, dip your finger in a soapy water solution.
  - b Use your finger to make the inside seal smooth.
- 4 All exposed edges must be sealed using Black Polyurethane Sealant (see **Sealing and Retaining Compounds**, Section 1).
- 5 Fit the external trim strip by cutting to length and pressing into position.
- 6 Clean the glass after installation:

**IMPORTANT:** Use extreme caution when wiping the inside of the new glass - pushing too hard on the inside of the glass will affect the integrity of the bonded seal.

- a Small amounts of sealant can be cleaned from the glass using the 'Active Wipe 205'.
- b Large amounts of excess sealant should be left to 'cure' (see **Note 4**) and then cut off with a sharp knife.

**Note 4:** On completion of the glass replacement procedures, the sealant 'curing' time is 30 minutes. This means that the machine can be driven and used after 30 minutes, but it **MUST NOT** be used during the curing period of 30 minutes.

- c Clean the glass using a purpose made glass cleaner.
- 7 On completion of the glass installation procedures tidy the work area:
    - a Remove ALL broken glass from the cab area.
    - b Remove the protective covers from the cab seat and control pedestals.
    - c Renew all 'warning' and 'information' decals so that the new installation conforms with the original cab installation.



A306820

## Operation

To maintain optimum operator comfort in warm climates or during seasons of high ambient temperature, the air conditioning system recirculates, clean, dehumidified air into the cab. Cooling is provided by passing the recirculated air, over an evaporator coil in the air conditioning unit.

The air conditioning system is a closed circuit through which the refrigerant is circulated, its state changing from gas to liquid and back to gas again, as it is forced through the system.

The major components of the system are the compressor **1**, condenser **2**, receiver drier **3**, expansion valve **4** and evaporator coil **5**.

### Heater/Air Conditioning Controls

Located on the **Left side of the Rear Panel**, the heater/air conditioning controls are used in conjunction with the heater fan controls.

#### Heater Controls

- A** Ventilation control - with the control turned fully clockwise, air to the heater is taken directly from outside the cab. With the control turned fully anti-clockwise, air to the heater is drawn from inside the cab and re-circulated. Settings between the two extremes result in varying mixtures of fresh and re-circulated air.
- B** Air flow control - with the control turned fully anti-clockwise, air flow from the heater is directed into the body of the cab. With the control turned fully clockwise air flow from the heater is directed at the windscreen. Settings between the two extremes result in degrees of partial flow to the cab and to the windscreen.
- C** Heat control - with the control turned fully clockwise, air flow from the heater is hot. With the control turned fully anti-clockwise air flow from the heater is cool. Settings between the two extremes result in varying temperatures.

#### Air Conditioning Controls (if fitted)

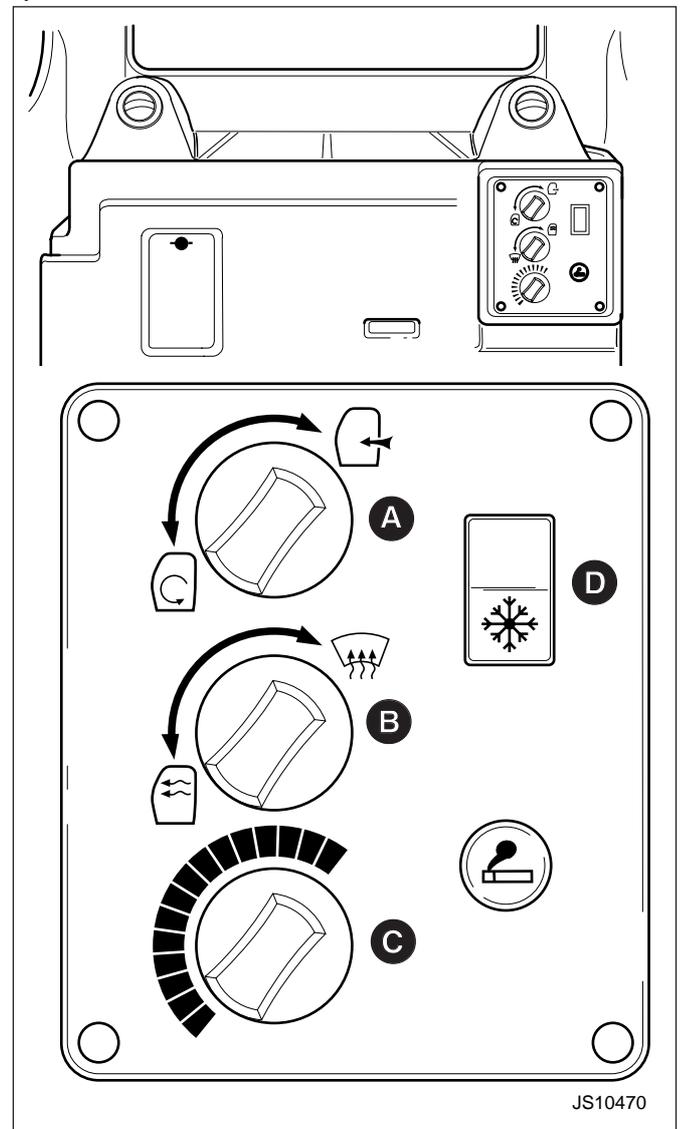
- D** Air conditioning ON/OFF control - this two position rocker switch is used to select or deselect the facility. When the 'snow flake' icon is pressed to switch air conditioning ON, the switch illuminates.

Air conditioning system power is generated from the engine, via an electromagnetic clutch to the compressor. Three switches, connected in series, are included in the clutch supply line, all must be closed for the clutch and therefore the air conditioning system to operate.

The compressor **1** draws in low pressure refrigerant gas from the suction line (evaporator to compressor) and increases refrigerant pressure through compression. This process also increases the refrigerant temperature.

High pressure refrigerant is forced from the compressor to the condenser **2**, which is mounted on the radiator on the side of the engine. Ambient air is drawn across the condenser by the engine-driven cooling fan. In the condenser, the refrigerant changes state to a high pressure, high temperature liquid but with a lower heat content.

The refrigerant passes through the receiver drier **3**, which contains a desiccant to remove moisture from the system. The receiver drier serves as a reservoir for refrigerant and also includes a filter to remove foreign particles from the system.



JS10470

## Operation (cont'd)

The high temperature, high pressure refrigerant is forced by compressor action into the expansion valve **4**, which meters the amount of refrigerant entering the evaporator. In the expansion valve the refrigerant instantaneously expands to become a low pressure, low temperature liquid.

The refrigerant is drawn through the evaporator coil **5** by the suction of the compressor. The temperature of refrigerant is now considerably below that of the air being drawn across the evaporator coil by the blowers. Heat is transferred from the ambient and recirculated air to the refrigerant, causing the low pressure liquid to vaporise and become a low pressure gas. Moisture in the air condenses on the evaporator coil and is drained away via condensate.

Cool de-humidified air is emitted through air vents into the cab.

The low temperature, low pressure, high heat content refrigerant gas, is now drawn by suction back to the compressor, where the cycle is completed.

## Control

Control of the system is achieved by the cyclic action of the compressor's electromagnetic clutch. When current is fed to the field coil of the compressor's clutch, a magnetic field develops between the field coil and the armature which pulls the field coil, complete with clutch assembly, onto the compressor's rotor. Since the clutch assembly is turned constantly by the crankshaft pulley drive belt, the compressor armature turns, starting the refrigeration cycle.

Current is fed to the field coil through three series switches whose contacts are controlled by the following:

- 1 The manual switch **D** in the cab
- 2 The thermostat switch monitoring the evaporator temperature
- 3 The high and low level pressure switch

Switch **D** will start the refrigeration cycle provided that the ambient temperature in the cab is greater than 0°C and the refrigerant pressure remains within the specified limits.

The thermostat has its sensor inserted in the evaporator coil. It controls the refrigeration cycle by switching the compressor clutch on and off to prevent freezing of the condensate on the evaporator coil.

The pressure level switch is housed in a common assembly located on the Receiver Drier. If the refrigerant pressure exceeds the upper pressure limit specified or falls below the lower limit, the contacts will open and the clutch will disengage, closing down the refrigeration cycle.

## Pressures Switch Settings

High Pressure Switch 28 bar (406 lbf/ in<sup>2</sup>)  
Low Pressure Switch 2.1 bar (30.4 lbf/ in<sup>2</sup>)

## Safety Procedures

The air conditioning system includes a pressurised closed circuit containing a non-CFC, environmentally friendly refrigerant, Type R-134a. Any service procedure which breaks into the closed circuit and therefore requires discharging of the system, must only be carried out by service personnel with specialist knowledge of air conditioning systems. The following guidelines should be adhered to by all personnel servicing the air conditioning system.

### WARNING

**The air conditioning system is a closed loop system and contains pressurised refrigerant. No part of the system should be disconnected until the system has been discharged by a refrigeration engineer, or a suitable trained person. You can be severely frostbitten or injured by escaping refrigerant**

4-3-4-1/2

### CAUTION

**Do not operate the air conditioning system when there is no refrigerant in the system, otherwise the compressor will be damaged.**

4-3-4-4

- 1 It is critical that the correct refrigerant (R-134a) is used and that charging is done only by qualified personnel. As a precaution, in case of accidental leakage, discharging and charging of the vehicle refrigerant system must be conducted in a well ventilated area.
- 2 Containers of refrigerant should be stored in a cool environment away from direct sunlight.

### WARNING

**Do not carry out welding operations close to the air conditioning refrigerant circuit. A poisonous gas is produced when refrigerant comes into contact with naked flames. Do not smoke or allow naked flames close to the refrigerant circuit.**

BF 1- 9

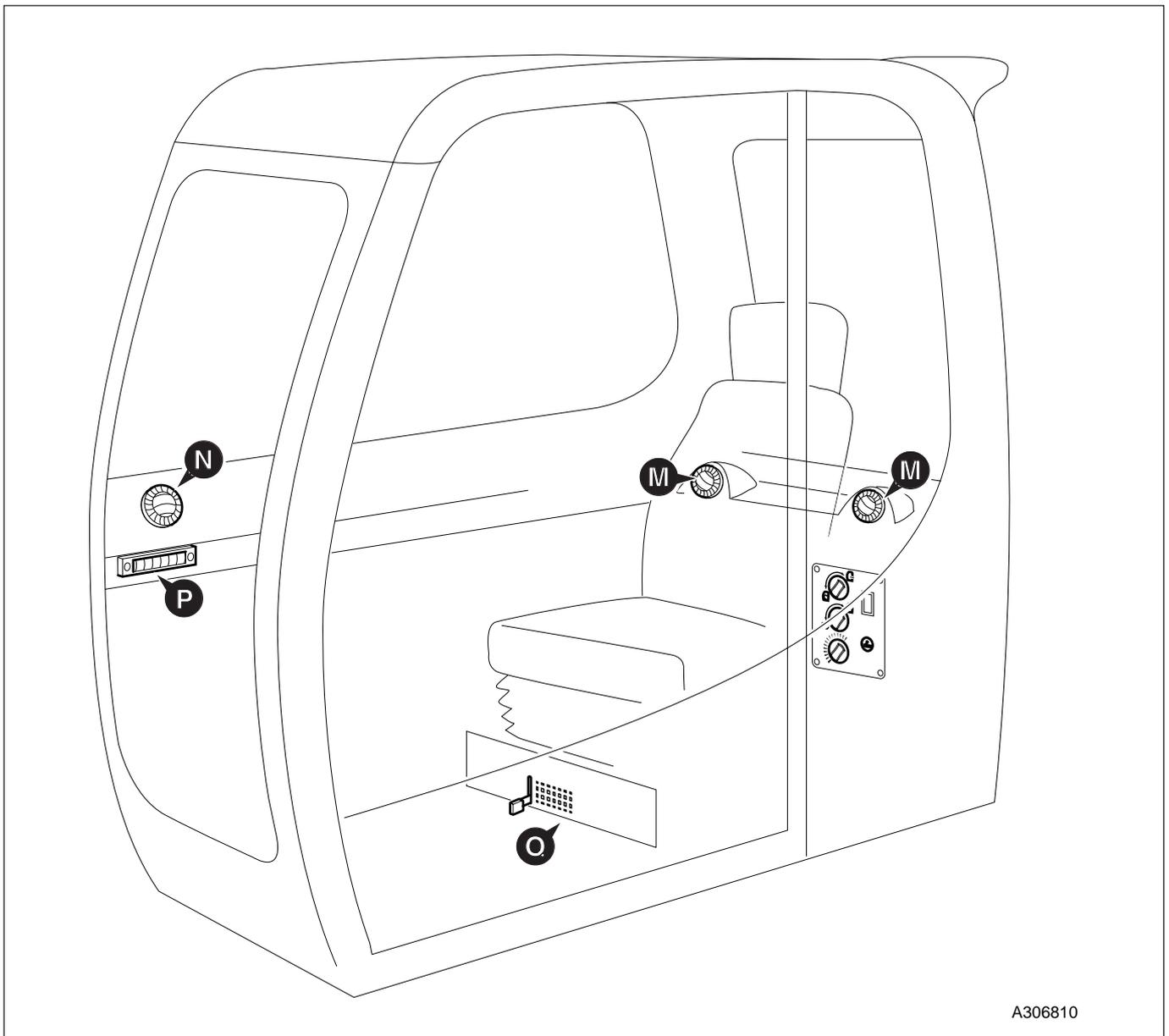
- 3 **Do Not** perform welding operations close to refrigerant hoses (maintain a distance of at least 0.5m from hoses).
- 4 **Do Not** steam clean refrigerant system components.
- 5 When charging or discharging the refrigerant system refrain from smoking. Naked flames must not be allowed in the immediate vicinity. The refrigerant does not give off a poisonous odour, however, when it comes into contact with a naked flame, a poisonous gas is produced.
- 6 When handling refrigerant, rubber gloves and goggles should be worn. Operators should ensure that no refrigerant comes into contact with the skin. Particular care should be taken when connecting or disconnecting charging hoses or pressure switches. When these components are connected to the system, a short release of refrigerant occurs. This results in a high velocity, very cold gas being emitted from the connection point.

### Operation (cont'd)

**Note:** In dusty conditions, it is recommended that air be recirculated within the cab, otherwise the filter may become clogged.

Two air vents **M** are located in the cab rear panel, and two air vents **N** and **P** are located on the right hand console. One air vent **Q** is located under the drivers seat. The vents can be turned to direct the air flow where required. When the vents are open, hot or cold air will flow directly into the cab.

For the most effective front window demisting, the air vents should be closed and air circulation control turned fully to the left.



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## Fault Finding

Procedures that require charging or discharging the system are not given in this manual as they require special equipment that is usually held only by trained refrigeration engineers. Fault indications are given in the table below.

The system will not function in very low ambient temperatures, therefore tests should be carried out in a warm environment.

It is recommended that, to locate faults on the system accurately and quickly, an electronic leak detector and a refrigerant pressure gauge should be used. However, leaks can be detected on the system by using soapy water applied to the suspected leak area and system pressure can be assessed by the state of refrigerant passing through the receiver drier sight glass. Following sections of the manual deal with the major components of the air conditioning system and give further fault finding and maintenance information.

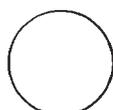
### General Fault Indications

There are several indications that may help to determine the fault area on a system not working efficiently:

a) Poor performance	Low system pressure -	Evacuate and recharge system. Remove debris from around coil using compressed air or low pressure water.
	Condenser coil air flow restricted -	
	Air filters blocked	Clean with detergent and water. Adjust to correct tension.
	Compressor drive belt too slack	
b) Warm or slightly cool air emitted from unit	Expansion valve stuck open or closed -	Renew expansion valve.
c) Blower does not operate	Fuse blown	Replace fuse (20A) and retest. Fault find and repair.
	Circuit fault	
d) Compressor clutch continually cuts out	Condenser coil blockage -	Remove debris from around coil/renew condenser. Evacuate and recharge system. Clear blocked component .
	Overcharging of refrigerant system-	
	Blocked expansion valve/condenser -	

### Sight Glass Indications

An approximate indication of the condition of the refrigerant can be seen through the receiver/drier sight glass when the compressor is running. Refer also to **Checking Refrigerant Charge Level**, on page 12-8.



S201520A

Clear - No fault indicated unless the system is unable to provide cool air. The indication then is that the system is completely discharged of refrigerant.



S201520B

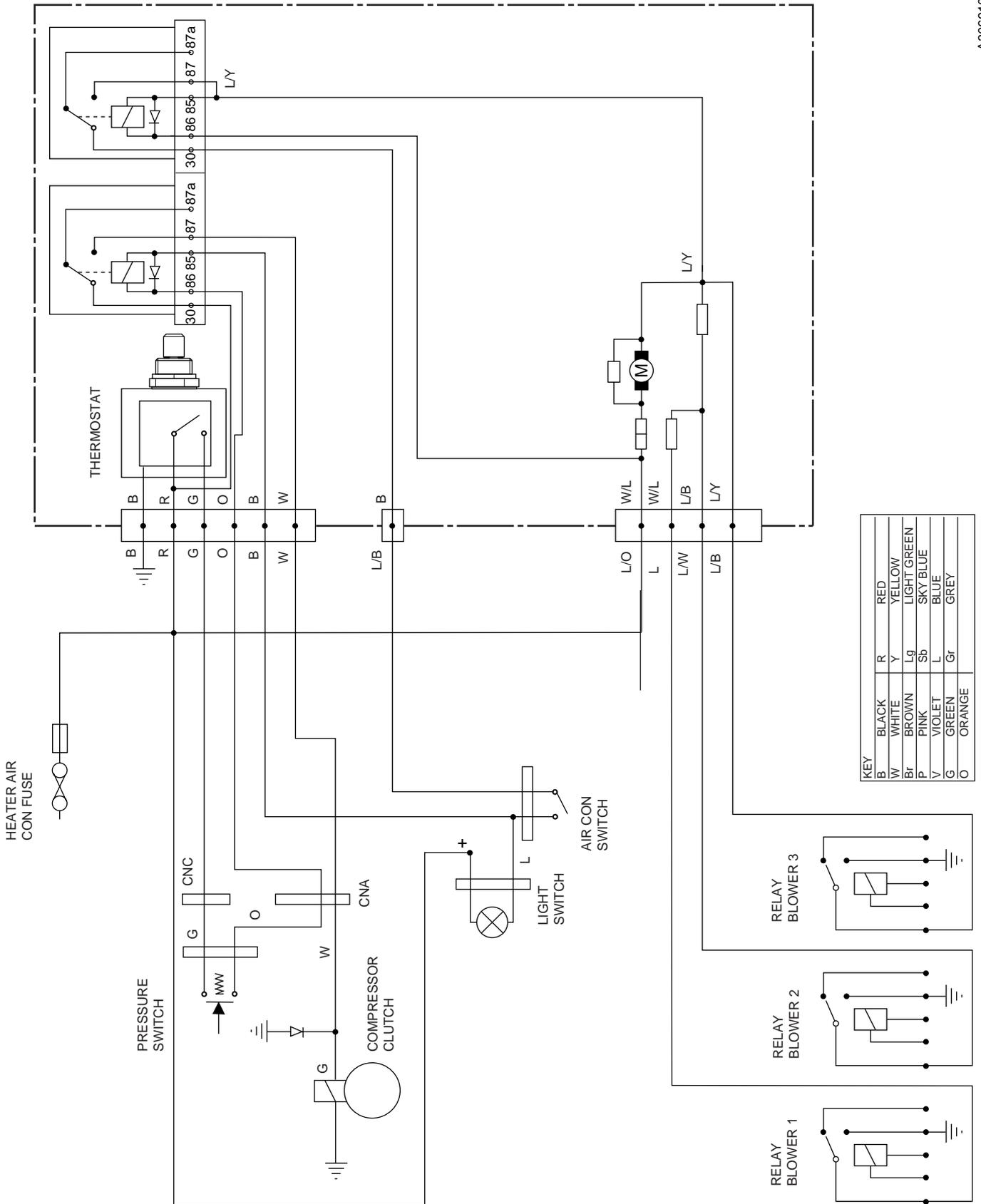
Foam or bubbles - Refrigerant low and in need of charging.



S201520C

Clouded - Desiccant breakdown in the receiver-drier.

**Note:** Sight glass indications cannot always give a positive identification of a problem. Further diagnosis, preferably by a refrigeration engineer using pressure gauges, is advisable before reaching a definite conclusion.



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**Fault Finding (cont'd)****No Air Conditioning**

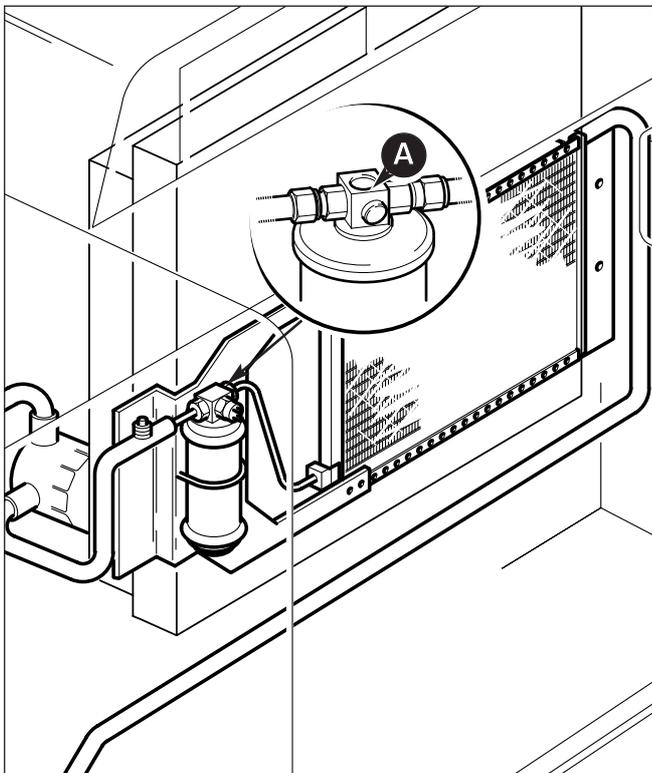
<b>CHECK</b>	<b>ACTION</b>
1 Are the controls set correctly, i.e. air conditioning selected, thermostat switch set to coldest position and blower switched on?	YES: Check 2 NO: Reset controls and retest.
2 Is the air conditioning (evaporator) blower working?	YES: Check 3. NO: Check 4.
3 Is the compressor running (visual check of pulley/clutch)?	YES: Check 9 NO: Check 5.
4 Is the air conditioning fuse(s) blown?	YES: Renew fuse(s) and retest. NO: Check 8.
5 Is there a 24V supply to the pressure switch harness?	YES: Check 6. NO: Check 7.
6 Does the compressor clutch engage with pressure switch assembly bypassed?	YES: Replace pressure switch assembly. NO: Renew the compressor clutch and retest.
7 Does the clutch engage with thermostat switch bypassed?	YES: Renew thermostat switch and retest. NO: Check all electrical connections.
8 Are blower switch and wiring OK?	YES: Renew blower unit complete. NO: Renew switch or wiring.
9 Is sight glass indication OK?	YES: Check 10. NO: Charge check required by refrigeration engineer.
10 Is condenser air flow blocked?	YES: Clean condenser and radiator. NO: Check 11.
11 Is evaporator air flow blocked?	YES: Clean filter and, if necessary the evaporator. NO: Call in refrigeration engineer.

## Checking Refrigerant Charge Level

The pressure in the system, i.e. the refrigerant charge level can be determined by checking the state of refrigerant at the receiver drier sight glass. The receiver drier is mounted on the radiator on the side of the engine.

If the level of charge is correct the sight glass will be clear. If the charge is low bubbles will be seen. Bubbles may also be an indication of inadequate cooling, due to a restriction of air flow around the condenser coil. Recharging of the system should be carried out by an air conditioning engineer. Check refrigerant charge level as follows:

- 1 Park the machine on firm, level ground. Lower the excavator arms to the ground. Engage the parking brake.
- 2 Open the left hand side, rear door.



- 3 Start the engine and run at idle. Switch air conditioning ON to circulate refrigerant.
- 4 Check refrigerant charge level at sight glass A.

## Leak Testing

### **⚠ WARNING**

**Leak testing in Air Conditioning systems should be carried out only in a well ventilated area.**

BF 1-2

**Note:** The refrigerant is heavier than air and will leak downwards from the defective component. Check in still conditions but in a well ventilated area.

Hose or pipe connections are likely leakage points of any refrigerant circuit.

To test for leaks in the high pressure side of the system i.e. from the compressor output to the expansion valve, run the air conditioning for a few minutes then switch off the engine and test for leakage using an electronic leak detector or soapy water.

To test for leakage in the low pressure side of the system, switch off the air conditioning and leave for a few minutes before testing.

## Tightening Leaking Hoses

### **⚠ WARNING**

**The air conditioning system is a closed loop system and contains pressurised refrigerant. No part of the system must be disconnected except by a qualified refrigeration engineer. You can be severely frostbitten or injured by escaping refrigerant**

4-3-4-1/1

The refrigerant hoses have crimped ferrule end fittings. The hose connectors have an 'O' ring seal which compresses when the connection is tight, creating an air tight seal.

Hoses are used to connect the inlets and outlets of the compressor, condenser, receiver drier and expansion valve (the evaporator coil is connected to the expansion valve within the air conditioning unit using rigid pipes).

If leakage is detected from a hose connector, either by means of an electronic leak detector or soapy water, tighten the connector up and repeat the leakage test. If leakage is still evident, it will be necessary to de-gas the system and renew the connector 'O' ring seal.

## System Diagnosis

### Normally Functioning A/C System

#### Gauge Readings:

**Low Side Gauge** - Normal.

**High Side Gauge** - Normal.

#### Other symptoms:

**Sight Glass** - Clear.

**Discharge Air** - Cold.

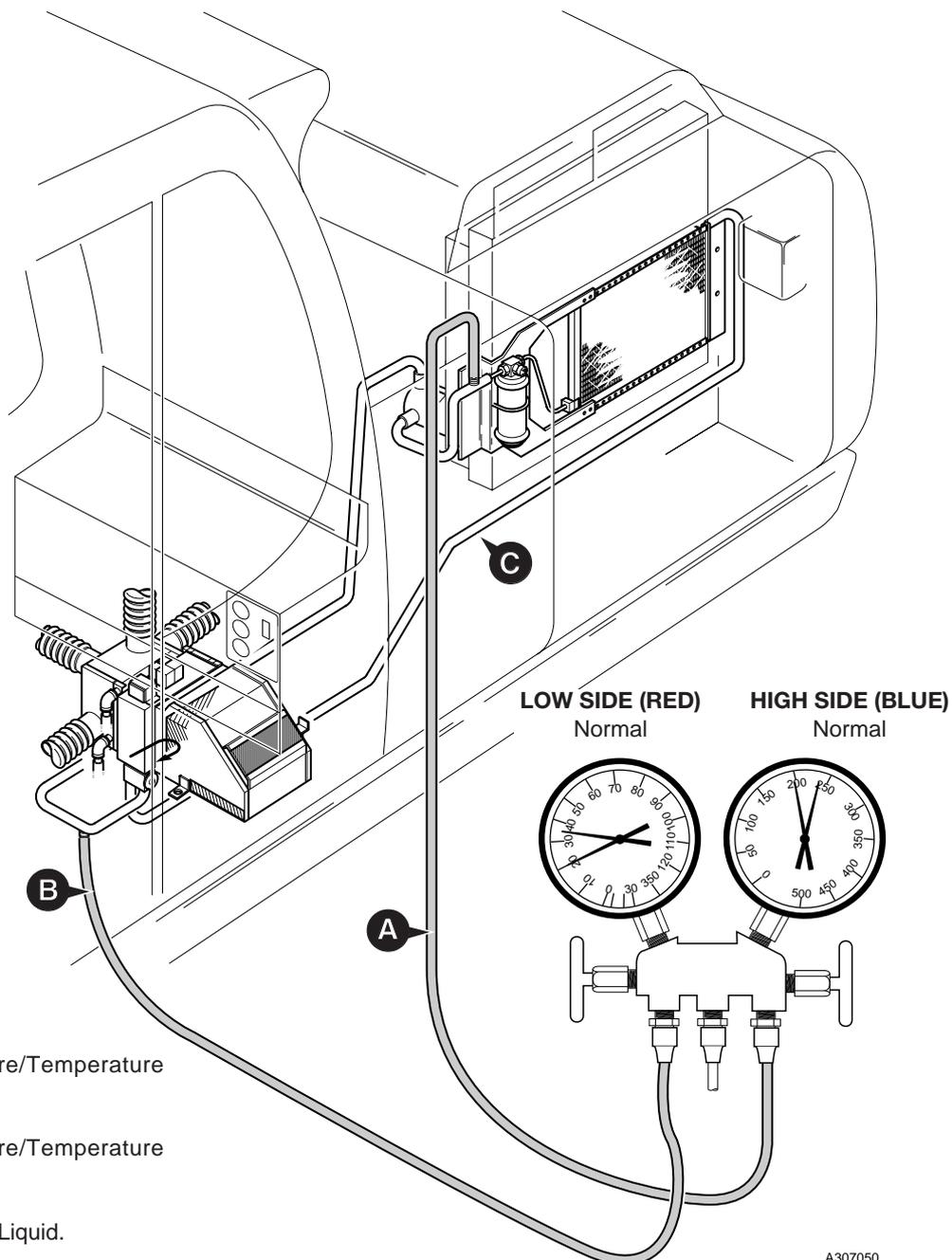
Normal gauge readings will depend on system components and ambient conditions, make sure that the valves are closed and the readings are stable and that the system has a full charge.

The pressures on the manifold at 25 °C with the engine at 1500 RPM, the blower on maximum and the thermostat set to maximum, should be approximately:

Typically, the high pressure is 6 - 8 times the low pressure.

LOW SIDE - 2.0 bar (2.0 kgf/cm<sup>2</sup>)(29 lbf/in<sup>2</sup>)

HIGH SIDE - 14.8 bar (15.1 kgf/cm<sup>2</sup>)(215 lbf/in<sup>2</sup>)



## System Diagnosis (cont'd)

### Low R-134a Charge

#### Gauge Readings:

**Low Side Gauge** - Low.

**High Side Gauge** - Low.

#### Other symptoms:

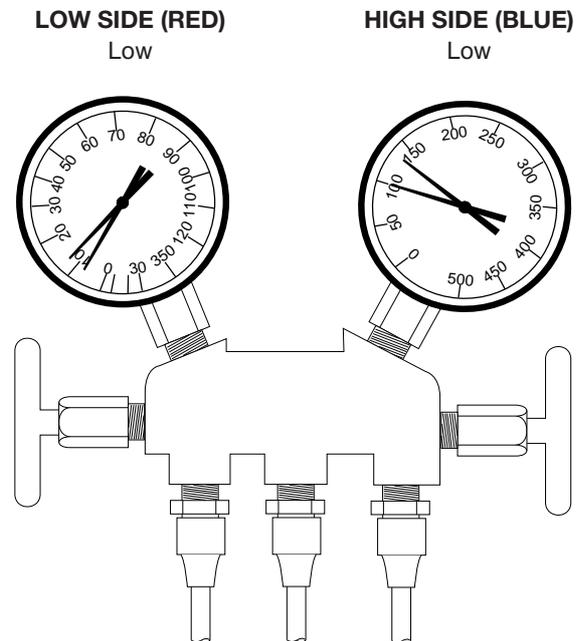
**Sight Glass** - Bubbles continuously visible.

#### Diagnosis:

**System slightly low on R-134a, due to leak or incorrect charge.**

#### Correction:

1. Leak test system.
2. Evacuate A/C system.
3. Repair system leaks.
4. Charge system with R-134a.
5. Operate system and check performance.



LOW SIDE - 0.76 bar (0.77 kgf/cm<sup>2</sup>)(11 lbf/in<sup>2</sup>)  
 HIGH SIDE - 8.3 bar (8.5 kgf/cm<sup>2</sup>)(121 lbf/in<sup>2</sup>)

### Poor Refrigerant Circulation

#### Gauge Readings:

**Low Side Gauge** - Zero to negative.

**High Side Gauge** - Low.

#### Other symptoms:

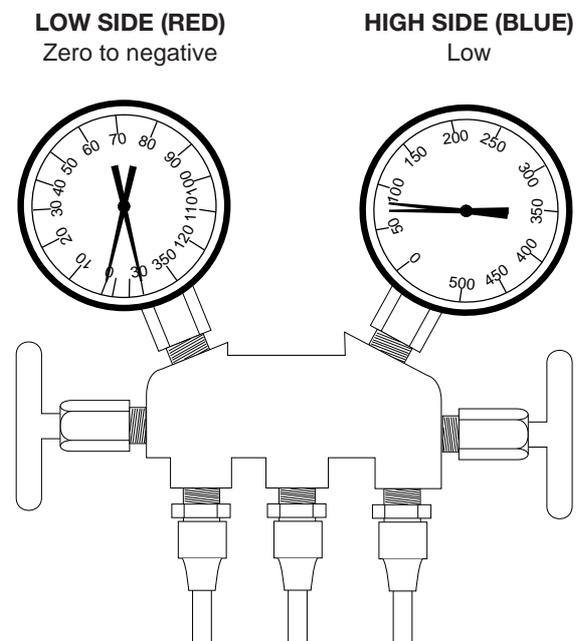
**Receiver-Drier** - Frost on tubes from receiver-drier to evaporator unit.

#### Diagnosis:

**Refrigerant flow obstructed by dirt, receiver-drier clogged.**

#### Correction:

1. Evacuate A/C system.
2. Replace receiver-drier.
3. Charge system with R-134a.
4. Operate system and check performance.



LOW SIDE - -1.0 bar (-1.1 kgf/cm<sup>2</sup>)(-15 lbf/in<sup>2</sup>)  
 HIGH SIDE - 5.4 bar (5.5 kgf/cm<sup>2</sup>)(78 lbf/in<sup>2</sup>)

## System Diagnosis (cont'd)

### No Refrigerant Circulation

#### Gauge Readings:

**Low Side Gauge** - Zero to negative.

**High Side Gauge** - Low.

#### Other symptoms:

**Receiver-Drier** - Frost or moisture on tubes before and after receiver-drier.

#### Diagnosis:

**Refrigerant flow obstructed by dirt, moisture or gas leakage from expansion valve heat sensing tube.**

#### Correction:

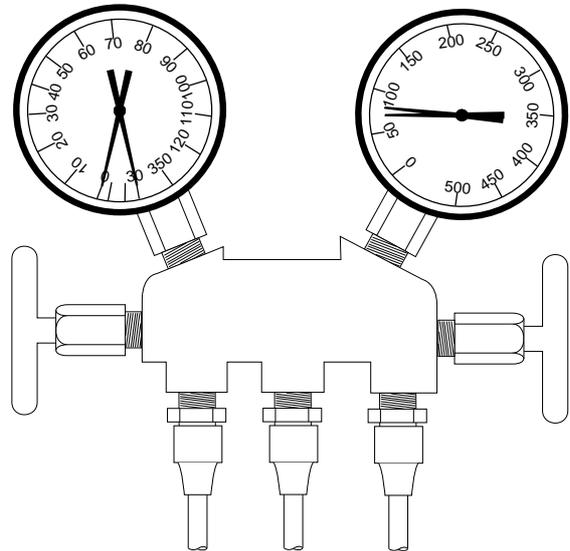
1. Evacuate A/C system.
2. Check heat sensing tube at expansion valve. Replace expansion valve if necessary.
3. Remove expansion valve and attempt removal of dirt. If dirt cannot be removed, replace expansion valve.
4. Replace receiver-drier.
5. Charge system with R-134a.
6. Operate system and check performance.

#### LOW SIDE (RED)

Zero to negative

#### HIGH SIDE (BLUE)

Low



LOW SIDE - -1.0 bar (-1.1 kgf/cm<sup>2</sup>)(-15 lbf/in<sup>2</sup>)

HIGH SIDE - 5.4 bar (5.5 kgf/cm<sup>2</sup>)(78 lbf/in<sup>2</sup>)

### Insufficient Cooling of Condenser or Refrigerant Overcharge

#### Gauge Readings:

**Low Side Gauge** - High.

**High Side Gauge** - High.

#### Other symptoms:

**Sight Glass** - No bubbles visible even at lower engine RPM.

#### Diagnosis:

**Refrigerant overcharge, condenser cooling fins clogged with dirt or cooling fans malfunctioning.**

#### Correction:

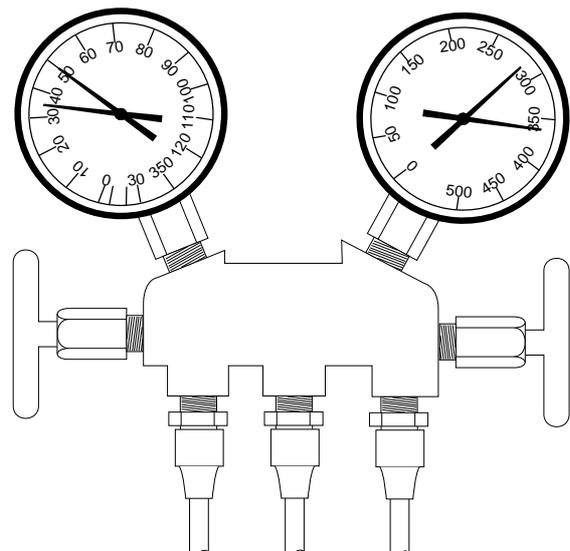
1. Clean condenser cooling fins.
2. Check cooling fan operation.
3. Evacuate A/C system.
4. Charge system with R-134a.
5. Operate system and check performance.

#### LOW SIDE (RED)

High

#### HIGH SIDE (BLUE)

High



LOW SIDE - 3.0 bar (3.0 kgf/cm<sup>2</sup>)(43 lbf/in<sup>2</sup>)

HIGH SIDE - 22.1 bar (22.5 kgf/cm<sup>2</sup>)(320 lbf/in<sup>2</sup>)

## System Diagnosis (cont'd)

### Air in System

#### Gauge Readings:

Low Side Gauge - High.

High Side Gauge - High.

#### Other symptoms:

**Sight Glass** - Bubbles visible during system operation.

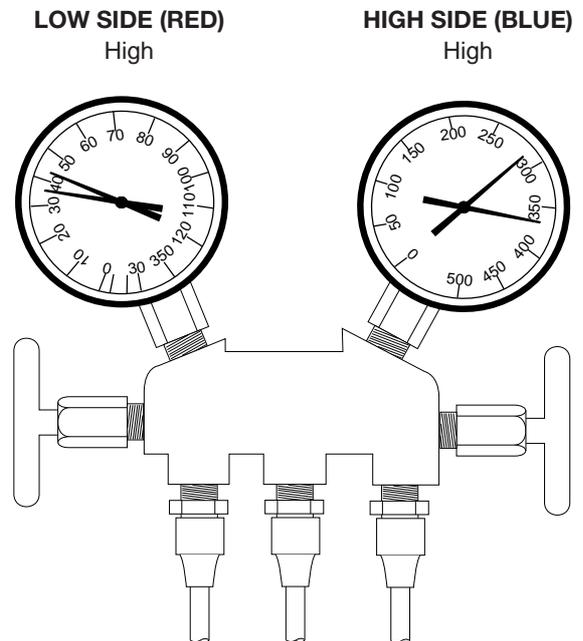
**Pipes** - Low pressure pipes are hot to the touch.

#### Diagnosis:

**Air is present in the system, possibly from inadequate evacuation procedure.**

#### Correction:

1. Evacuate A/C system.
2. Check compressor oil for contamination. Check compressor for proper oil amount. Correct if necessary.
3. Charge system with R-134a.
4. Operate system and check performance.



LOW SIDE - 2.8 bar (2.8 kgf/cm<sup>2</sup>)(40 lbf/in<sup>2</sup>)  
HIGH SIDE - 22.1 bar (22.5 kgf/cm<sup>2</sup>)(320 lbf/in<sup>2</sup>)

### Expansion Valve Improperly Mounted or Heat Sensing Tube Defective (Opening Too Wide)

#### Gauge Readings:

Low Side Gauge - High.

High Side Gauge - High.

#### Other symptoms:

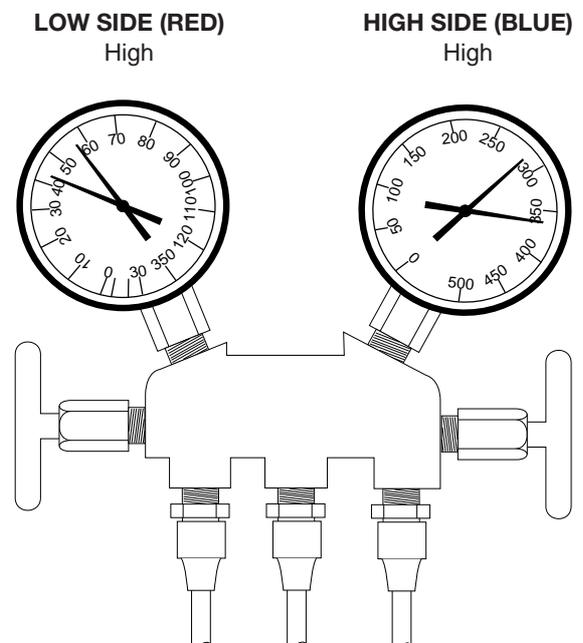
**Pipes** - Large amount of frost or moisture on low side pipes.

#### Diagnosis:

**Excessive refrigerant in low side pipes possibly from expansion valve being opened too wide.**

#### Correction:

1. Leak test system.
2. Evacuate A/C system.
3. Repair system leaks.
4. Charge system with R-134a.
5. Operate system and check performance.



LOW SIDE - 3.5 bar (3.5 kgf/cm<sup>2</sup>)(50 lbf/in<sup>2</sup>)  
HIGH SIDE - 22.1 bar (22.5 kgf/cm<sup>2</sup>)(320 lbf/in<sup>2</sup>)