NOTE: This instruction describes the service and replacement procedures for the Carlisle range of CCV Master Cylinder assemblies. Information contained in this publication is subject to change without notice or liability.

WARNING: For optimum results and safety, Carlisle recommends that all work should be carried out by a suitably trained fitter/mechanic. If it is decided to replace used components or assemblies, always use genuine Carlisle replacement parts. If in doubt seek professional help.

WARNING: Any defective master cylinder assembly must be replaced with a new genuine Carlisle assembly.

WARNING: This unit is available to suit vegetable DOT 4 brake fluid and mineral brake oil systems. The system compatibility can easily be identified by an ID band attached to all units. Black ID bands indicate DOT 4 brake fluid compatibility and Green ID bands indicate mineral brake oil compatibility. Failure to use the correct fluid/brake oil will lead to system contamination and premature failure of components. Use only Brake Fluid/Mineral Brake Oil recommended by the vehicle manufacturer.

CAUTION: Always ensure appropriate safety glasses and gloves are worn when carrying out the procedures detailed below.
Park the vehicle on hard ground and chock the wheels. Follow the vehicle manufacturer's recommendations to gain access to the master cylinder. Ensure the parking brake is applied and no hydraulic pressure is held in the system.

Clean any dirt or debris from the master cylinder assemblies paying particular attention to the areas around the hydraulic connections.

**WARNING:** If the areas around the hydraulic connections are not cleaned before the connections are removed there is a possibility that debris can enter the cylinder hydraulic ports during the connection removal process. Any debris entering the hydraulic ports will compromise the cylinder function and could lead to premature failure.

Check the rubber dust excluders (1). The dust excluders should be soft and flexible and fit tightly in the locating groove on the cylinder and around the push rod (4). A dust excluder which shows signs of cracking, embrittlement, swelling or any other damage must be replaced.

Peel back the dust excluder from the location on each cylinder. If the internal surfaces of the dust excluder contains brake oil that has emulsified into a grease consistency, this is a normal condition and acceptable.

**NOTE:** If, when a dust excluder is detached from a cylinder assembly, brake oil runs from the excluder this may indicate the failure of the cylinder's internal sealing arrangement and the cylinder assembly must be replaced using a new genuine Carlisle assembly.

**NOTE:** Although it may be that only one of the cylinders is exhibiting a fault, it is recommended that both cylinders are replaced or serviced in a tandem arrangement to maintain an efficient system.

**Master Cylinder Removal**

The CCV master cylinder is available in a number of configurations to meet specific installation requirements. Fig 1 shows a typical CCV MK4 cylinder which is utilised in a tandem arrangement where both cylinders are mounted independently and operated with a latched or un-latched pedal arrangement.

Fig 2 shows a typical CCV Binocular arrangement. This configuration has cylinders in a tandem arrangement, but attached to a common mounting plate (23). The binocular configuration can incorporate an integral reservoir, or use a remote supply.

**NOTE:** The orientation of the brake port and method of securing the master cylinder unit to the vehicle may vary due to different vehicle installations. Before removal note the orientation of the master cylinder assembly and position of the hydraulic pipework connection (Fig. 1 & Fig. 2) to aid re-assembly.
CAUTION: Ensure any residue brake oil / brake fluid from the disconnected hydraulic pipe or master cylinder assembly is caught in a suitable container and/or wiped clean with a suitable cloth. Dispose of any residue brake oil or contaminated cloth in accordance with local environmental regulations.

Drain the braking system of brake oil by attaching a rubber tube to a bleed screws, unscrew the bleed screws half a turn and pump out the brake oil/brake fluid into a suitable container by operating the coupled foot pedals.

Remove the hydraulic pipe connection/s from the master cylinder and carefully ease the hydraulic pipe/s clear of the master cylinder hydraulic port/s.

Note: The supply pipes/hoses may be connected to the master cylinder using port adaptors, or screwed directly into the master cylinder threaded inlet port.

Disconnect the push rod from the foot pedal linkage. Remove the nuts, or where applicable bolts, securing the master cylinder assembly to the vehicle bulkhead.

Carefully remove the master cylinder assembly from the vehicle taking care to avoid spillage of any residual brake oil from the hydraulic ports or fluid reservoir.

NOTE: If the cylinder assemblies are to be serviced, this must be carried out in a clean environment.

Dismantling

CAUTION: Do not use any type of sharp implement to remove the internal seals during the dismantling process. Any damage to the seal location grooves on the valve head, plungers or flow valve will prevent correct seal location and may lead to insufficient sealing and premature failure of components.

CCV MK4 (Fig. 1)
Secure the cylinder in a vice (Fig. 3). Take care not to damage the cylinder by over tightening the vice.

Carefully remove the flow valve adaptor (12) using a suitable 22mm spanner. Remove the cylinder from the vice and carefully turn it over on the work surface. The flow valve (14) and ball bearing (16) should fall out onto the work surface, if they don’t, gently tap the cylinder on a soft wooden surface to release them. Place the ball bearing to one side for re-use. Remove the seal (15) from the valve stem.

Binocular Arrangement (Fig. 2)
Integral Reservoir
Release the rubber hose and clips connecting the reservoir to the supply port adaptor and discard them. The reservoir and adaptor can now be removed.

IMPORTANT: Each master cylinder must be serviced separately to avoid mixing components.

Place the assembly upside down (bridge pipe on top Fig. 4) on a clean work surface. This will prevent the flow valves (14), should they be a loose fit, from falling out whilst removing the bridge pipe or valve port adaptor. Remove the hydraulic bridge pipe (19).

Cylinders without flow valve port adaptors
Carefully turn the assembly over until the flow valve assemblies (14) fall out of the ports. It may be necessary to tap the assembly on a soft wooden surface to release the valve assemblies. Pull off the mounting bracket (23) connecting the two master cylinder assemblies and secure one of the cylinders in a vice. Take care not to damage the cylinder by over tightening the vice.

Cylinders with flow valve port adaptors
Pull off the mounting bracket (23) connecting the two cylinders and secure one of the cylinders, still inverted, in a vice (Fig. 3). Take care not to damage the cylinder by over tightening the vice. Carefully remove the flow valve adaptor (12) then remove the cylinder from the vice and carefully turn it over on the work surface. The flow valve (14) and ball bearing (16) should fall out onto the work surface, if they don’t, gently tap the cylinder on a soft wooden surface to release them. Place the ball bearing to one side for re-use. Remove the seal (15) from the valve stem.
All Cylinders
Pull back the dust cover (1), and using a pair of long nosed pliers release the circlip (2) and washer (3). Remove the push rod and dust cover. The plunger assembly can now be extracted by either shaking the cylinder or carefully applying low pressure air to the inlet port after blocking off the remaining ports.

IMPORTANT: Take care not to damage the inlet ports.

Lift the leaf (28) of the spring retainer (Fig. 5) and remove the spring assembly from the plunger. Compress the spring (5) to free the valve stem (10) from the keyhole of the spring retainer (6) and release the tension on the spring. Remove the spring valve spacer (9) and the curved washer (21) from the valve stem, and the valve seal (11) from the valve stem head. Carefully remove the plunger seal (8) from the plunger.

Cleaning and Inspection

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The comparison of the parts contained in the Kit with those removed will indicate which parts to discard. Examine the plunger and cylinder bore for score marks and corrosion.

Check the cylinder bore is perfectly smooth to the touch. If there is the slightest doubt as to the condition, a new guaranteed Carlisle master cylinder must be fitted.

If the old seals appeared to be loose when they were removed compare them with the new equivalent seals.

IMPORTANT: To avoid contamination do not allow the old and the new seals to come into contact.

If the old seals appear to be appreciably larger than the new ones then contamination is indicated and the whole system should be thoroughly flushed out with new brake oil or brake fluid. Thoroughly clean all parts with new brake oil, or brake fluid, before assembly.

Re-Assembly
All Cylinders

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Use the appropriate new parts from the service kit when reassembling. Lubricate the inner diameters of seal, before fitting with unused brake oil/brake fluid. Fit the new plunger seal (8) onto the plunger (Fig. 5) and the new centre valve seal (11), onto the valve steam head (10) as shown in Fig. 6. Position the curved washer (11) onto the valve stem (11) so it “flares” away from the valve stem shoulder (Fig. 6), then follow on with the valve spacer (9) and the spring (5) inside the spacer as shown Fig.5. Fit the spring retainer (6) to the spring and compress the spring until the valve stem (11) passes through the keyhole in the spring retainer and engages the centre. Fit the spring sub assembly immediately to the plunger and press home the leaf (28) of the spring retainer to secure (Fig. 5). Liberally lubricate the plunger assembly and the cylinder bore with new unused Brake Oil. Insert the plunger assembly into the cylinder bore easing the entrance of the plunger seal. Position the pushrod and retaining washer and fit the circlip. Smear the sealing area of the dust cover with the grease.

CAUTION: Use only the grease recommended by the vehicle manufacturer. The use of any other grease could lead to contamination of the dust excluder and may lead to insufficient sealing and premature failure of components.
**Note:** Prior to fitting the flow valve seal you will notice a raised portion on the sealing face (Fig. 7). This raised portion is a design feature of the seal, not a moulding flash. Do not remove this material.

**CCV MK4**
Secure the cylinder in a bench vice. Carefully fit the flow valve seal to the flow valve (14). Place the ball bearing (21) into the flow valve port, ensure it comes to rest in the hole through to the bore (Fig. 8).
Insert the flow valve (14) into the flow valve port. Ensure it is positioned carefully over the ball bearing (Fig. 8). Fit the gasket (13) onto the flow valve adaptor (12), carefully screw the adaptor into the flow valve port by hand.
if any resistance is felt before it is fully screwed down, unscrew it, recentralise the flow valve and refit the adaptor.
Tighten the adaptor to a torque value of 41 to 47Nm.

**Binocular Arrangement**

**Cylinders with flow valve port adaptors**
Secure the cylinder in a bench vice in the inverted position, as shown in Fig. 3, then carefully fit the flow valve seal to the flow valve (14). Place the ball bearing (21) into the flow valve port (Fig. 8), ensure it comes to rest in the hole through to the bore. Insert the flow valve (14) into the flow valve port. Ensure it is positioned carefully over the ball bearing (Fig. 8).
Install the gasket (13) on the flow valve adaptor (12), carefully screw the adaptor into the flow valve port by hand. if any resistance is felt before it is fully screwed down, unscrew it recentralise the flow valve and refit the adaptor.
Tighten to the correct torque of 41 to 47Nm

**Cylinders without flow valve port adaptors**
Turn the master cylinder upside down on the work surface, fit the new flow valve assemblies and inserts and fit the hydraulic bridge pipe. Tighten the bridge pipe nuts to a torque of 9 - 11Nm.

**Fit the seal to the inlet port (17) (Fig. 12). Press the inlet port adaptor (18) or reservoir (24), whichever is appropriate, firmly into the seal, ensuring that the lip of the adaptor or reservoir locates in the bottom of the seal, as shown with the adaptor example Fig. 12.
Repeat the sequence with the other cylinder fitting either the reservoir or the port adaptor. Tighten the reservoir strap (27) to a load of 60 to 90N, trimming off the excess material.
Fit the new rubber hose from the kit between the inlet port on the one cylinder and the reservoir on the other securing it with the new clips.
Invert the two cylinders and reconnect the hydraulic bridge pipe (19) tightening the nuts to a torque of 9 to 11Nm.

**Cylinders with flow valve port adaptors**

**Fit the master cylinder assembly to the vehicle bulkhead, in the correct orientation and secure with the retaining nuts/bolts. Tighten the fixings to the torque value specified by the vehicle manufacturer.**

**Refit the hydraulic pipe work connection/s to the hydraulic port/s on the master cylinder assembly. Refer to the note made at master cylinder removal if necessary.**
Reference should be made to the following table for the correct tightening torque for each of the various hydraulic fittings.

<table>
<thead>
<tr>
<th>Description</th>
<th>Thread Specification</th>
<th>Tightening Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master cylinder Retaining Bolt / Nut</td>
<td>Refer to the vehicle manufacturers recommendations</td>
<td></td>
</tr>
<tr>
<td>Supply Ports</td>
<td>M14 x 1.5 - 6H</td>
<td>23 – 27 Nm</td>
</tr>
<tr>
<td>Outlet Ports</td>
<td>M14 x 1.5 - 6H</td>
<td>23 – 27 Nm</td>
</tr>
<tr>
<td>Bridge Pipe Ports</td>
<td>M10 x 1 -6H</td>
<td>9 - 11 Nm</td>
</tr>
<tr>
<td>Flow Valve Adaptor</td>
<td></td>
<td>41 – 47 Nm</td>
</tr>
</tbody>
</table>

**NOTE:** The brake pedal must be in the at rest position, held against the pedal backstop by the pedal return spring during pushrod connection/adjustment.

Connect the push rods to the brake pedal linkage.

**IMPORTANT:** The pushrod to plunger clearance is critical and must be set following the procedure detailed below.

**Bleeding Procedure**

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**Pre-Bleeding**
Attach transparent bleed pipes to both brake bleedscrews.

- Open both bleedscrews half a turn.
- Start the engine and run at idle, until the bleeding procedure has been completed.

**Bleeding the Brake System**
Bleed the right hand brake using full strokes of the right hand brake pedal only.
Close the right hand bleedscrew when the fluid runs free of air bubbles.
Check the right hand pedal travel.

**NOTE:** Repeat the bleeding procedure as necessary.

Open left hand bleedscrew.
Couple the brake pedals and bleed the left hand brake.

**NOTE:** When bleeding with the pedals coupled increased pedal effort will be observed. Also it will not be possible to achieve a full pedal stroke due to the master cylinder compensation block.

Close the left hand bleedscrew when all air has been expelled from the system. Check pedal travel, single and coupled.

**NOTE:** Repeat the bleeding procedure as necessary.

With engine running, check for leaks.
Hydraulic Port Adaptor Replacement

NOTE: There may be sufficient working access on certain installations which allow the hydraulic port adaptors to be replaced without the need to remove the cylinder assembly. If sufficient access is available disregard the cylinder removal and re-fitting detail contained in this publication. If there is any doubt, regarding sufficient access, always remove the cylinder assembly following the Master Cylinder Removal section of this publication.

Adaptor Removal

Cylinders Fitted to the Vehicle
Using a suitable hose clamp, clamp off the flexible rubber hose, close to the adaptor (18).

Remove the flexible rubber hose from the adaptor.

All Cylinders
Remove the adaptor (18) (Fig 11) from the hydraulic port and discard.

WARNING: Ensure the hydraulic port is not damaged during the removal of the adaptor seal. Any damage could prevent correct fitment of the new adaptor and seal or lead to premature failure of the assembly.

Carefully remove the adaptor seal (17) (Fig 11) from the hydraulic port.

Compare the size of the adaptor seal removed from the cylinder with the new adaptor seal. DO NOT allow any contact between the used and new seal.

If the new seal appears to be smaller than the used seal removed from the cylinder, this could indicate system fluid contamination.

If there is any doubt in the suitability for further service, always replace the cylinder assembly with a new genuine Carlisle replacement.

Adaptor Fitment

WARNING: This unit contains special synthetic rubber components. Use only Mineral Brake Oil recommended by the vehicle manufacturer. Failure to use the correct brake oil can lead to premature failure of components.

Lubricate the new adaptor seal (17) with new, unused brake oil to the correct specification.

Carefully locate the new seal (17) correctly in the cylinder hydraulic adaptor port (Fig 12).

Carefully push the adaptor (18) through the adaptor seal (17), until it locates correctly (Fig 12).

Refit the cylinder assembly following the Master Cylinder Fitment section of this publication, or

Cylinders Fitted to the Vehicle
Refit the flexible rubber hose to the adaptor. Remove the hose clamp from the flexible rubber hose.