

# F

# MODULES

**YUKEN's Modular Valves** are stack type valves, and require no piping. They not only rationalise system build, but they also meet the technical requirements for a variety of hydraulic systems. Stacking systems is a new era in hydraulics.

The valves have standardized mounting surface conforming to ISO 4401 and optimum thickness for each size. Any hydraulic circuits can be easily composed by stacking the valves with mounting bolts. The valves can be used widely for hydraulic systems for various industries such as machine tools, special purpose machines, ships and steel mill equipment.

| Valve Type                   | Max. Operating Pressure<br>MPa<br>(PSI) | Maximum Flow |         | Page |
|------------------------------|---|--------------|---------|------|
|                              |   | L/min        | U.S.GPM |      |
| 005 Series<br>Modular Valves | 25<br>(3630)                            | 005          |         | 517  |
| 01 Series<br>Modular Valves  | 31.5<br>(4570)                          | 01           | 01 *    | 535  |
| 03 Series<br>Modular Valves  | 25<br>(3630)                            | 03           | 03 *    | 577  |
| 06 Series<br>Modular Valves  | 25<br>(3630)                            | 06           |         | 619  |
| 10 Series<br>Modular Valves  | 25<br>(3630)                            | 10           |         | 633  |

★ Maximum Flow for Throttle and Check Modular Valves.

## Hydraulic Fluids

### Fluid Types

Any type of hydraulic fluid listed in the table below can be used.

|                         |   |
|-------------------------|---|
| Petroleum Base Oils     | Use fluids equivalent to ISO VG 32 or VG 46.  |
| Synthetic Fluids        | Use phosphate ester or polyol ester fluids. When phosphate ester fluid is used, prefix "F-" to the model number because the special seals (fluororubber) are required to be used. |
| Water-containing Fluids | Use water-glycol fluid.   |

Note: For use with hydraulic fluids other than those listed above, please consult your Yuken representatives in advance.

### Recommended Fluid Viscosity and Temperature

Use hydraulic fluids which satisfy the both recommended viscosity and oil temperatures given in the table below.

| Name   | Viscosity                                      | Temperature                |
|--|--|----------------------------|
| 005 Series Modular Valves  | 15 - 200 mm <sup>2</sup> /s<br>(77 - 900 SSU)  | -15 - +60°C<br>(5 - 140°F) |
| 01 Series Modular Valves<br>03 Series Modular Valves<br>06 Series Modular Valves<br>10 Series Modular Valves | 15 - 400 mm <sup>2</sup> /s<br>(77 - 1800 SSU) | -15 - +70°C<br>(5 - 160°F) |

### Control of Contamination

Due caution must be paid to maintaining control over contamination of the hydraulic fluids which may otherwise lead to breakdowns and shorten the life of the valve.

| Name   | Contamination             | Nominal Filtration |
|--|---------------------------|--------------------|
| 005 Series Modular Valves  | Within NAS1638 - Grade 11 | 20 μm or less      |
| 01 Series Modular Valves<br>03 Series Modular Valves<br>06 Series Modular Valves<br>10 Series Modular Valves | Within NAS1638 - Grade 12 | 20 μm or less      |

## High Pressure, High Flow Rate Modular Valves

### Features

1. Installation and mounting space can be minimized.
2. No special skill is required for assembly and any addition or alteration of the hydraulic circuit can be made quickly and easily.
3. Problems such as oil-leaks, vibration and noise which may be caused by piping are minimized, increasing the reliability of the hydraulic system.
4. Maintenance and system check-ups can be easily carried out as they are normally installed in stackable units.

### Specifications

| Series     | Valve Size | Max. Operating Pressure<br>MPa (PSI)                   | Max. Flow<br>L/min (U.S.GPM)                          | Number of Stack <sup>*2</sup> |
|------------|------------|--|---|-------------------------------|
| 005 Series | —          | 25<br>(3630)   | 15<br>(3.96)  | 1 to 4 stacks                 |
| 01 Series  | 1/8        | 31.5<br>(4570)   | 35 [60] <sup>*1</sup><br>(9.24 [15.9]) <sup>*1</sup>  | 1 to 5 stacks <sup>*3</sup>   |
| 03 Series  | 3/8        | 25 [31.5] <sup>*4</sup><br>(3630 [4570]) <sup>*4</sup> | 70 [120] <sup>*1</sup><br>(18.5 [31.7]) <sup>*1</sup> | 1 to 5 stacks                 |
| 06 Series  | 3/4        | 25<br>(3630)   | 500<br>(132)  |                               |
| 10 Series  | 1-1/4      | 25<br>(3630)   | 800<br>(211)  |                               |

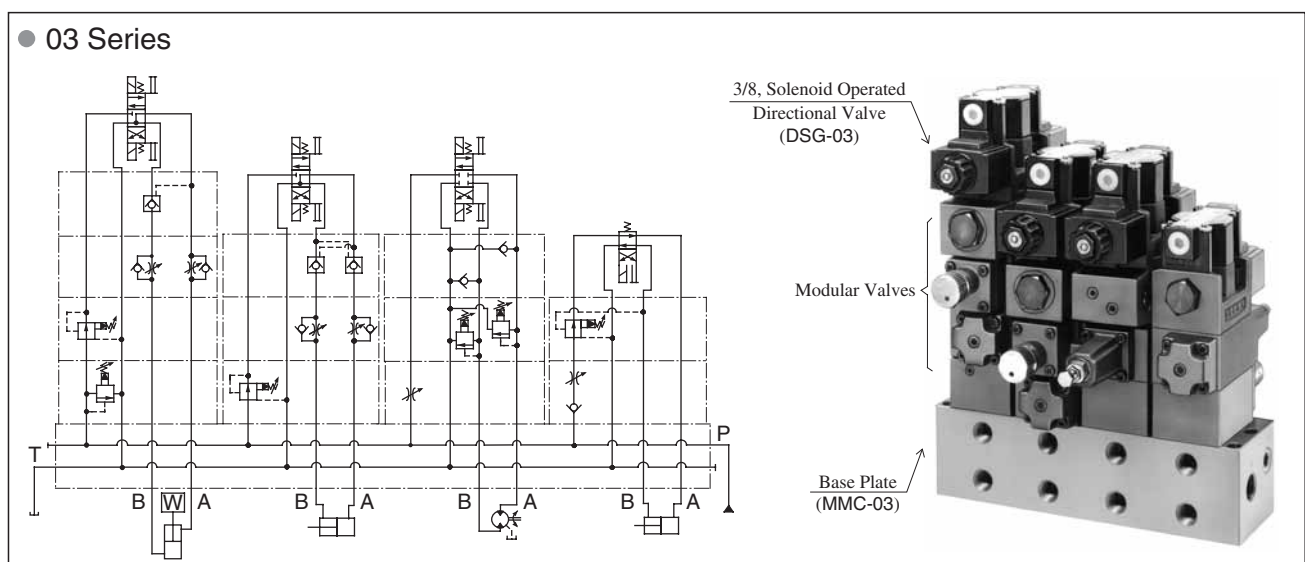
- ★ 1. The values in parentheses represent the max. flow rates for throttle modular valves (MSP) and throttle check modular valves (MSA/MSB/MSW).
- ★ 2. Solenoid operated directional valve is included in the number of stack.
- ★ 3. Solenoid operated directional valve is included in the number of stack. If the working pressure is above 25 MPa (3630 PSI), the maximum number of layers in a stack is 4 including the solenoid operated directional valve.
- ★ 4. The value range in parentheses represents the tightening torque requirements if the operating pressure is above 25 MPa (3630 PSI).

### Mounting Surface

Mounting surface dimensions conform to ISO 4401 (Hydraulic fluid power four port directional control valves mounting surface) as listed in the table below.

| Name of Valve           | ISO Mtg. Surface Code No. |
|-------------------------|---------------------------|
| 01 Series Modular Valve | ISO 4401-AB-03-4-A        |
| 03 Series Modular Valve | ISO 4401-AC-05-4-A        |
| 06 Series Modular Valve | ISO 4401-AE-08-4-A        |
| 10 Series Modular Valve | ISO 4401-AF-10-4-A        |

### Stacking Example



**Instructions**

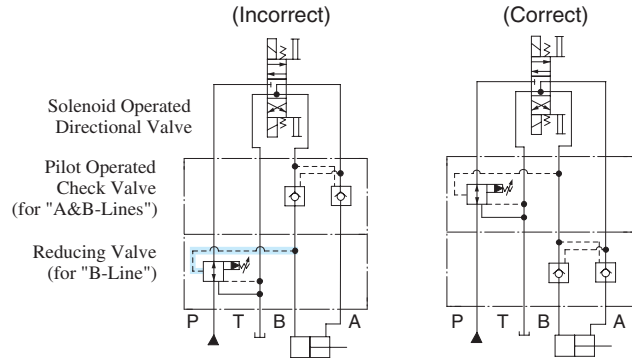
**Caution in the selection of valves and circuit designing**

The selection of modular valves, to suit a particular function or hydraulic circuit, are made in exactly the same way as conventional valves, taking into account of the flow and pressure of each valve to be used. In some cases, the stacking system may be restricted, so please refer to the following instructions for stacking sequence. Please note, that when designing a system using modular stacking valves, due consideration should be given to working space for future maintenance.

**Stacking sequence when using reducing valves (for "A" or "B" line) and pilot operated check valves.**

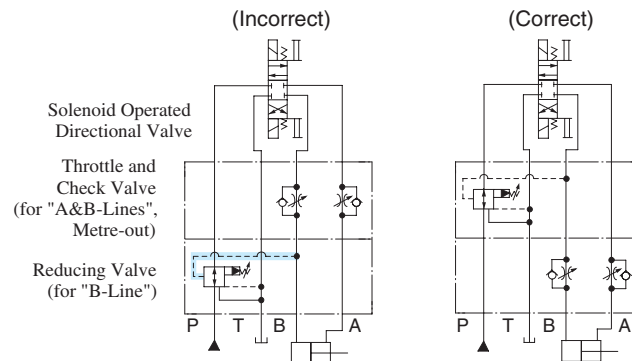
Because reducing valves are spool type, there is an internal leakage. In the stacking sequence shown in the drawing left (incorrect), the cylinder moves due to leakage through the pilot pressure line.

Consequently, retaining the position of the cylinder using a pilot operated check valve becomes impossible. The stacking sequence shown in the drawing right (correct) is required in order to retain the cylinder position.



**Stacking sequence when using reducing valves (for "A" or "B" line) and throttle and check valves (for metre-out).**

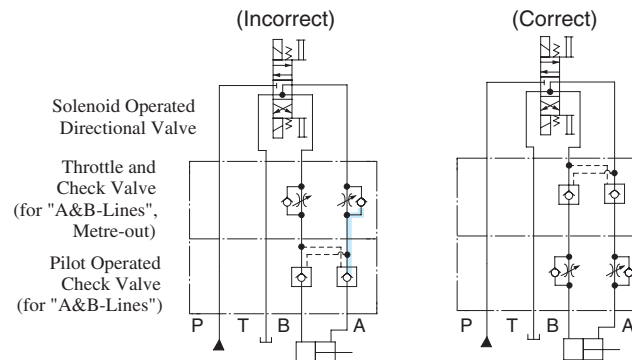
In B to T flow in the drawing left (incorrect), pressure is generated at part with a throttle effect of the throttle and check valve. Depending upon the pressure so generated, the reducing valve may perform a pressure reducing function which causes a shortage of output power of the cylinder and spoils the smooth operation of the cylinder. Therefore, stacking sequence in the drawing right (correct) is required in this combination.



**Stacking sequence when using pilot operated check valves and throttle and check valves (metre-out).**

In A to T flow in the drawing left (incorrect), pressure is generated at part with a throttle effect of the throttle and check valve.

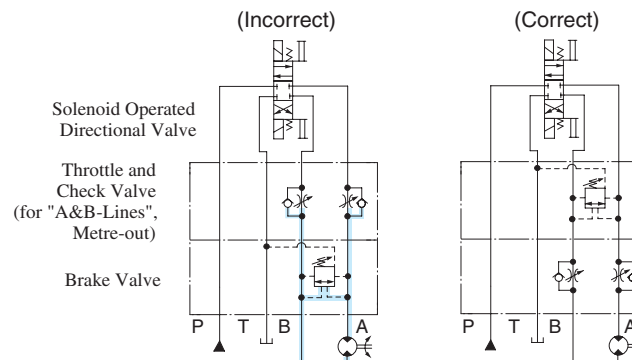
The pressure so generated acts to shut the pilot operated check valve and eventually creates an open and shut operation of the valve repeatedly which may cause the cylinder to have a knocking effect (the same effect will occur in the case of B to T flow). Therefore, the stacking sequence in the drawing right (correct) is required in this combination.



**Stacking sequence when using brake valves and throttle and check valves.**

In the drawing left (incorrect), pressure is generated at part (a load pressure and a back pressure from throttle effect). For structural reasons of the brake valve, the load pressure and back pressure act to open the valve, therefore, the setting pressure should be more than the pressure equal to the load pressure plus back pressure ( $P_a + P_b$ ). If the setting pressure is less than  $P_a + P_b$ , the brake valve acts and brakes the movement of the actuator in operation, this eventually reduces the speed of the actuator.

On the contrary, if the setting pressure is more than  $P_a + P_b$ , shock may occur when braking the actuator since the setting pressure is too high against the load pressure. Therefore, the stacking sequence in the drawing right (correct) is required in this combination.



## Base Plates and Sub-Plates

When mounting the modular valves, use base plates and sub-plates specified below. If these base plates and the sub-plates are not used, ensure that the mounting surface has a good machined finish.

| Series     | Base Plates                                   |      | Sub-Plates    |      |
|------------|---|------|---------------|------|
|            | Model Numbers                                 | Page | Model Numbers | Page |
| 005 Series | MMC-005-* -20                                 | 531  | DSGM-005* -20 | 342  |
| 01 Series  | MMC-01-* -40                                  | 573  | DSGM-01* -31  | 356  |
| 03 Series  | MMC-03-T-* -21                                | 615  | DSGM-03* -40  | 373  |
| 06 Series  | Consult your Yuken representative in advance. | —    | DHGM-06* -50  | 402  |
| 10 Series  | Consult your Yuken representative in advance. | —    | DHGM-10* -40  | 403  |

## Assembly

Assembly should be carried out in clean conditions and in accordance with the following procedure. Cautious attention should be paid to ensure that the interface of the valves are clean and free from dirt or other foreign materials.

### Assembly Procedure:

- 005 Series
  - 1) To stack modular valves and solenoid operated directional valves according to circuit requirements, match the O-ring surfaces to the mounting surface and check the alignment of the locating pins.
  - 2) Align the right and left sides of the stacked valves.
  - 3) Tighten the four mounting bolts to the specified tightening torque.
  - 4) Perform an operational test and re-check mounting bolt torque, re-tightening if required.
- 01-10 Series
  - 1) Screw-in the four stud bolts(06 and 10 series: six stud bolts), fully into the tapped holes on the mounting surface of the specified base plate, sub-plate or manifold.
  - 2) Stack the modular valves and solenoid operated directional valves in accordance with the hydraulic circuit, place the O-ring inserted surface face onto the base plate and make sure that the port arrangement of the modular valves are in the correct position before stacking the valves onto the stud bolts.
  - 3) Align both the end of the valves stacked.
  - 4) Screw-in the four nuts(06 and 10 series: six nuts) onto the stud bolts and tighten with the specified torque. After the test run, be sure to re-tighten the nuts firmly within the specified torque.

## Pressure Drop

Pressure drop curves of the modular valves are those based on viscosity of 35 mm<sup>2</sup>/s (164 SSU) and specific gravity of 0.850.

When using the modular valves in conditions other than the above mentioned, find the appropriate values referring to the following table and formula.

- For any other viscosity, multiply the factors in the table below.

| Viscosity | mm <sup>2</sup> /s | 15   | 20   | 30   | 40   | 50   | 60   | 70   | 80   | 90   | 100  |
|-----------|--------------------|------|------|------|------|------|------|------|------|------|------|
|           |                    | SSU  | 77   | 98   | 141  | 186  | 232  | 278  | 324  | 371  | 417  |
| Factor    |                    | 0.81 | 0.87 | 0.96 | 1.03 | 1.09 | 1.14 | 1.19 | 1.23 | 1.27 | 1.30 |

- For any other specific gravity (G'), the pressure drop (ΔP') may be obtained from the following formula.

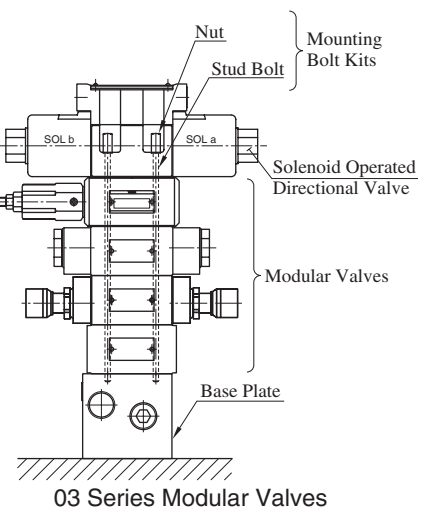
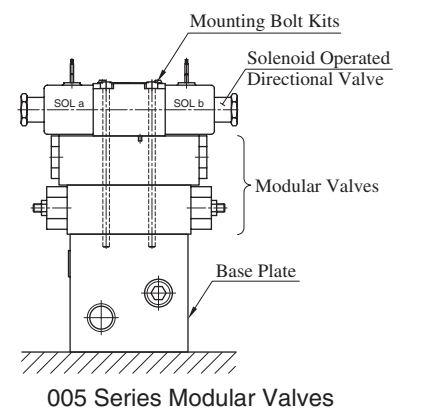
$$\Delta P' = \Delta P (G'/0.850)$$

## Mounting Bolts

Modular valves are mounted using stud bolts which are supplied in a kit form. When mounting, see the following table for tightening torque. After the test run, be sure to tighten again firmly within the specified torque.

| Series     | Bolt Kit Model Numbers | Tightening Torque Nm (in. lbs.) |
|------------|------------------------|---------------------------------|
| 005 Series | MBK-005-* -20          | 2.5-3.5 (22-31)                 |
| 01 Series  | MBK-01-* -30           | 5-6[6-7] (44-53[53-62])★        |
| 03 Series  | MBK-03-* -10           | 12-15 (106-133)                 |
| 06 Series  | MBK-06-* -30           | 50-60 (443-531)                 |
| 10 Series  | MBK-10-* -10           | 150-170 (1330-1505)             |

★ The value range in parentheses represents the tightening torque requirements if the operating pressure is above 25 MPa (3630 PSI).

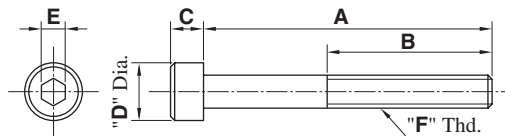


**■ Interchangeability in Installation between Current and New Design**

The model changed for the following models have been made.

| Models     | Model Numbers                       |  | Mtg. Interchangeability | Main changes   |
|------------|-------------------------------------|--|-------------------------|--|
|            | Current                             | New                                    |                         |  |
| 005 Series | Throttle and Check Modular Valves   | MSW-005-* -10                          | A<br>MSB-005-* -20<br>W | Yes<br>● Modification for large flow use.<br>● Addition of the valve for A & B lines.  |
|            | Pilot Operated Check Modular Valves | MP <sup>B</sup> <sub>W</sub> -005-2-10 | A<br>MPB-005-2-20<br>W  | Yes<br>● Modification for large flow use.<br>● Addition of the valve for A lines.  |
|            | Base Plates                         | MMC-005-* -10                          | MMC-005-* -20           | Yes<br>Change of the port hole dia. for large flow use (3.4 Dia. → 4.3 Dia.).  |
|            | Bolt Kits                           | MBK-005-* -10                          | MBK-005-* -20           | Yes<br>● Addition of bolt kit for 4-stage stacking.<br>● Change the bolt kit model numbers to conform to the required bolt length for the 01 to 10 series (See the table below for details.) |
| 01 Series  | Throttle Modular Valves             | MSP-01-30                              | MSP-01-50               | Yes<br>Modification for large flow use.  |
|            | Throttle and Check Modular Valves   | A<br>MSB-01-* *-40<br>W                | A<br>MSB-01-* *-50<br>W | Yes<br>Improved Controllability and Operability.   |
| 03 Series  | Relief Modular Valves               | MB*-03-* -20                           | MB*-03-* -30            | Yes<br>Higher Operating Pressure.  |
|            | Reducing Modular Valves             | P<br>MRA-03-* -20<br>B                 | P<br>MRA-03-* -30<br>B  | Yes<br>Modification for large flow use.  |

**■ Comparison of MBK-005 bolt kit model numbers**



| Bolt Kit Model Numbers |                 | Dimensions mm (Inches) |                |                 |                |               | "F" Thd.    | The number of the laminating steps quantity of valves to be stacked including solenoid operated directional Valve |
|------------------------|-----------------|------------------------|----------------|-----------------|----------------|---------------|-------------|---|
| (New) 20 Design        | (Old) 10 Design | A                      | B              | C               | D              | E             |             |   |
| MBK-005-01-20          | MBK-005-02-10   | 65(2.56)               | 20<br>(0.79)   | 4<br>(0.16)     | 7<br>(0.28)    | 3<br>(0.12)   | M4          | 2   |
| MBK-005-02-20          | MBK-005-03-10   | 95(3.74)               |                |                 |                |               |             | 3   |
| MBK-005-03-20          | —————           | 125(4.92)              |                |                 |                |               |             | 4   |
| MBK-005-05-20          | MBK-005-05-10   | 35(1.38)               |                |                 |                |               |             | 1   |
| MBK-005-01-2090        | MBK-005-02-1090 | 65.1(2-9/16)           | 22.4<br>(0.88) | 4.17<br>(0.164) | 6.86<br>(0.27) | 3.6<br>(9/64) | No.8-32 UNC | 2   |
| MBK-005-02-2090        | MBK-005-03-1090 | 95.2(3-3/4)            |                |                 |                |               |             | 3   |
| MBK-005-03-2090        | —————           | 125.4(4-15/16)         |                |                 |                |               |             | 4   |
| MBK-005-05-2090        | MBK-005-05-1090 | 34.9(1-3/8)            |                |                 |                |               |             | 1   |