3.3 OPERATION

(1) Construction

The valve consists of the following parts in terms of hydraulic function :

A : Damper section

B : Reducing valve section

C : Shuttle section

(2) Operation

1) Damper section

- If the primary pressure is supplied by P, it is flowed to the damper chamber by way of circuits Ⓓ and Ⓔ .

  The pressure is then filled up in the damper chamber via the orifice and the check valve.

  In that case, the air present in the damper chamber is pushed out to the T port from circuits Ⓕ and Ⓖ , in order to prevent the damper characteristics from fluctuating by air mixture.

- If the cam operates during travel operation, the oil in the damper chamber is kept from flowing back by the check valve. Thus the oil flows to part Ⓔ only from the orifice. Damper action operates by the resistance that is built up as the oil passes through the orifice.

  Let us explain the profile of the piston (See Fig. 3-4.)

  The upper part of the piston has a diameter of 12mm(0.472in), while the lower part of it has a diameter of 11mm(0.433in). This results in an areal difference, with the result that the piston is constantly subject to a vertical force. For this reason, the orifice rises by the pressure caused by the areal difference between the operating part of the cam and the piston on the opposite side i.e. the piston follows the cam.

  That is to say, constant damper action operates wherever the cam is located.

  Since the larger diameter of the piston, the cover, the 11mm diameter part of the piston and the guide are manufactured with minimal clearance, only a little leakage occurs. Consequently, the damper performance is not affected at all.

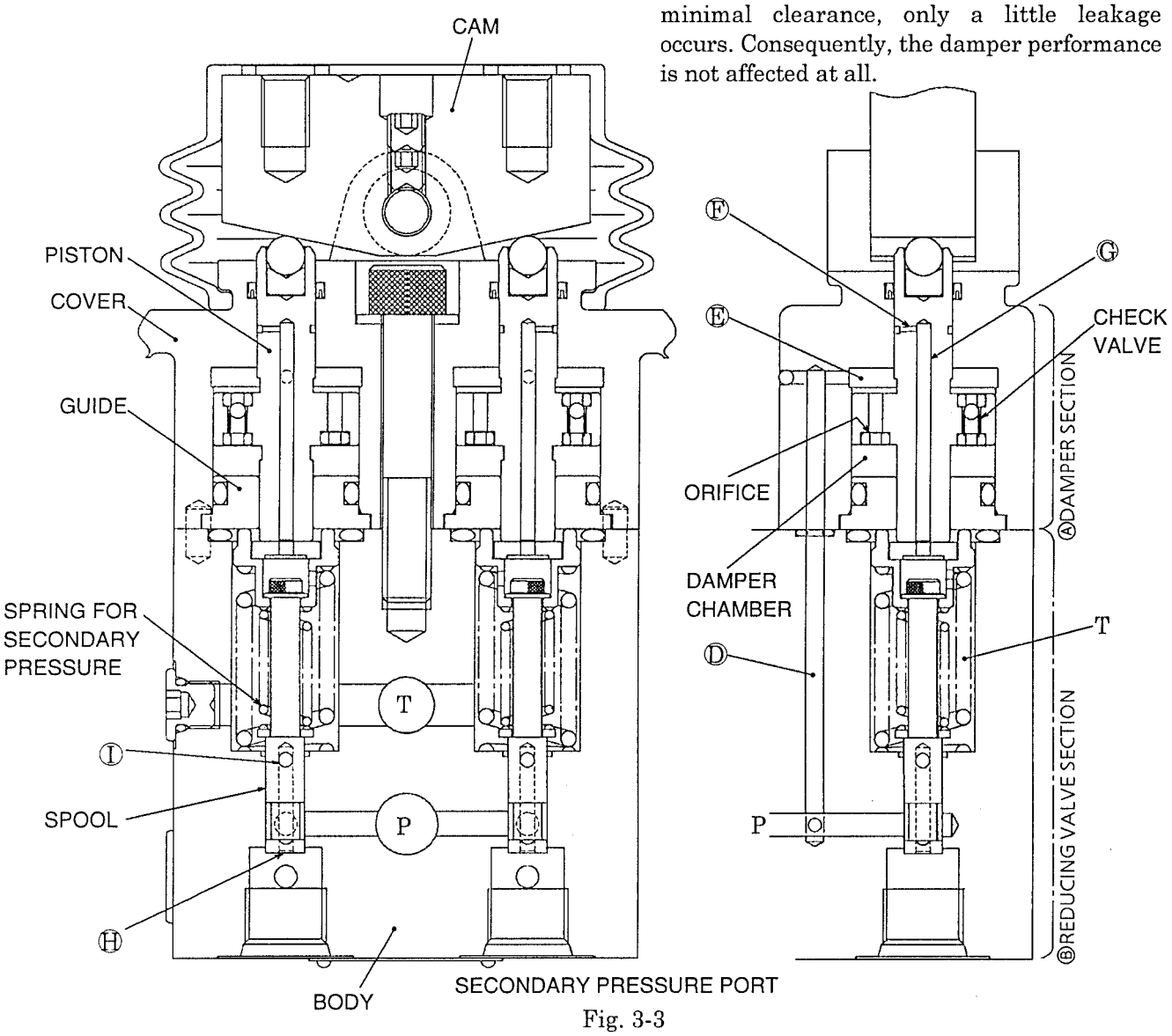

Fig. 3-3

2) Reducing valve section

- At neutral

  The primary pressure supplied by P is shut off by the seal between the circumference of the spool and the body hole.

  The secondary pressure port is connected with the T port through the vertical hole Ⓗ and the horizontal hole Ⓘ in the center of the spool. This causes the pressure to be reduced to zero.

- At operation

  If the cam tilts toward the operating direction, the piston goes down. The spool sub assy moves down.

  If the notch Ⓙ on the circumference of the spool connects with the secondary pressure port, the primary pressure supplied by P enters the secondary pressure port.

  In that case, the horizontal hole Ⓘ enters the hole of the body and seals it. As the result, the circuit from the secondary pressure port to the T port is shut off.

If the pressure at the secondary pressure port rises above the action of the secondary pressure spring, the spool is pushed up by the pressure. The result is that the notch Ⓙ enters the hole of the body, shuts off the circuit from the primary pressure port to the secondary pressure port, and causes the horizontal hole Ⓘ to connect with the T port to let the pressure of the secondary pressure port out to the T port.

If the above-mentioned action is repeated, the pressure at the secondary pressure port becomes a level that balances the compressive load of the secondary pressure spring proportional to the cam stroke.

The return spring provides proper repulsive force and positively brings the spool of the reducing valve back to its neutral position.

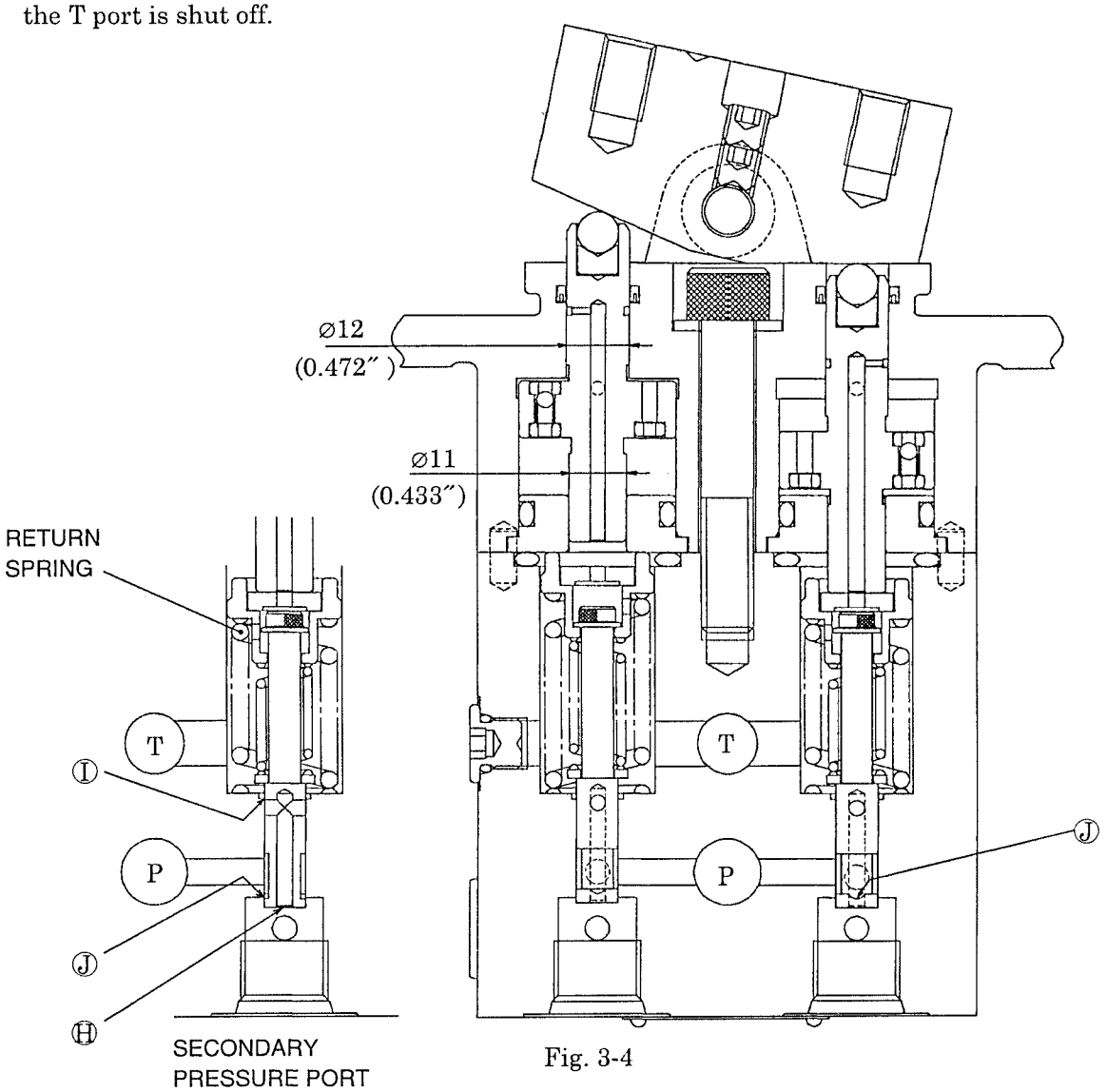

Fig. 3-4

3) Shuttle section

- If pressure is built up at port 1 or 3, the ball is pressed against the seat by the pressure. The pressure goes through from port 1 to port 5(or from port 3 to port 6).
  Only a little leakage occurs from port 2 or 4 as the ball is sealed metallically by the seat.
  If pressure occurs at port 2 or 4, the ball is pressed against the body by the pressure. The result is that the pressure connects with port 5 from port 2(with port 6 from port 4).
  Only a little leakage occurs at port 1 or 3 as the ball is sealed metallically against the body.

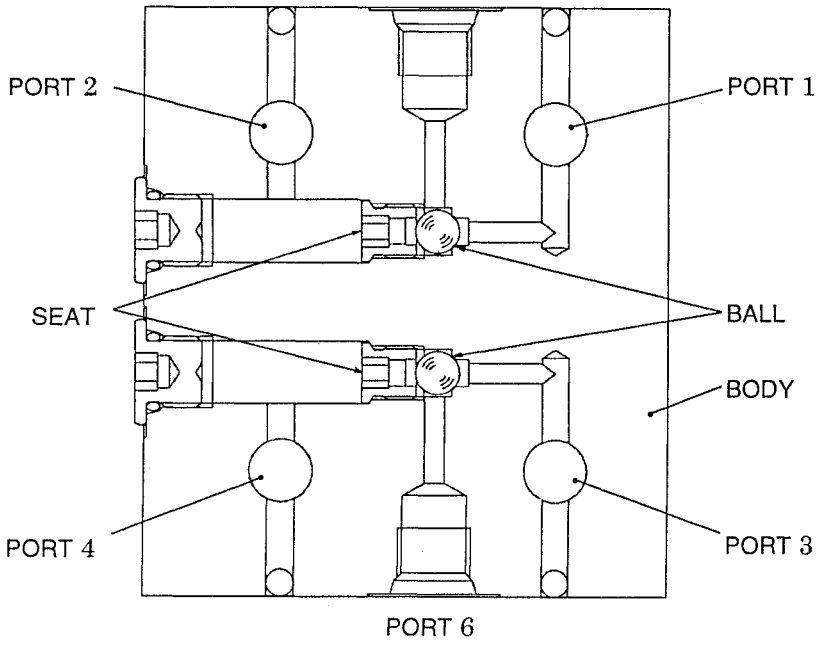

Fig. 3-5 Shuttle section

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4-1 CONTROL VALVE

4-1-1 SPECIFICATION EU

(This shows the valve with OPT1 and OPT2.)

(1) General view and hydraulic ports

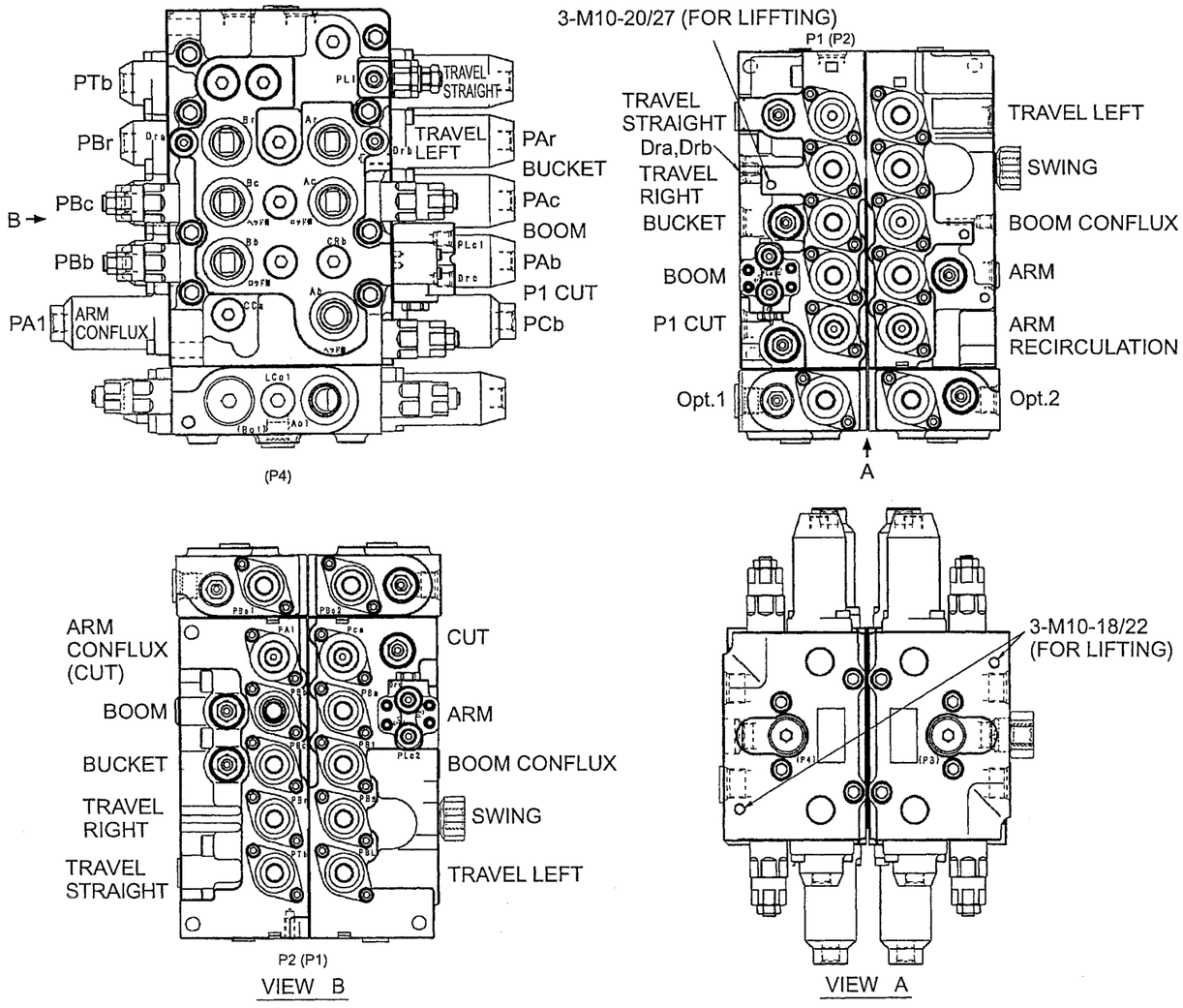

Table. 4-1 (1/2)

Port size	Tightening torque kgf·m (lbf·ft)	Port name	Description
PF3/4	15~18 (110~130)	P1	Pump P1 port
		P2	Pump P2 port
		Ab	Boom up port
		Bb	Boom down port
		Ac	Bucket dump port
		Bc	Bucket digging port
		Ar	Travel right port (forward)
		Br	Travel right port (reverse)
		AL	Travel left port (forward)
		BL	Travel left port (reverse)
		Aa	Arm in port
		Ba	Arm out port
		As	Swing port (right)
		Bs	Swing port (left)
		Ao1	Option 1 port (A)
		Bo1	Option 1 port (B)
		Ao2	Option 2 port (A)
		Bo2	Option 2 port (B)

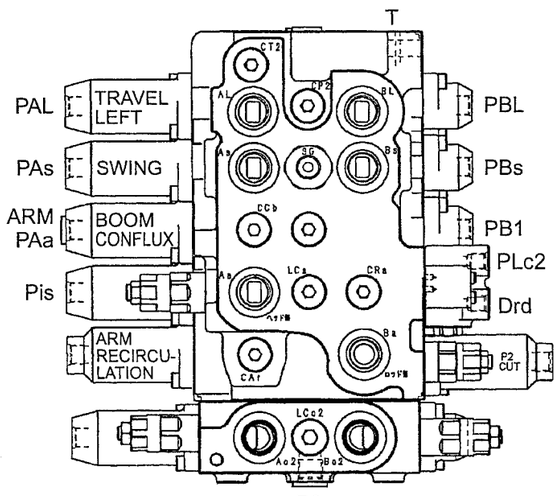

Table. 4-1 (2/2)

Port size	Tightening torque kgf·m (lbf·ft)	Port name	Description
PF1/2	10~12 (72~87)	(P3)	Option port
		(P4)	Option port
		SG	
PF3/8	7~8 (51~58)	PAa	Arm in pilot port
		PBa	Arm out pilot port
		PAb	Boom up pilot port
		PBb	Boom down pilot port
		PAc	Bucket dump pilot port
		PBc	Bucket digging pilot port
		PAr	Travel right pilot port (forward)
		PBr	Travel right pilot port (reverse)
		PAL	Travell left pilot port (forward)
		PBL	Travel left pilot port (reverse)
		PAs	Swing right pilot port
		PBs	Swing left pilot port
		Pis	Arm recirculation port
		PA1	Arm conflux pilot port
		PB1	Boom conflux pilot port
		PTb	Travel straight pilot port
		PCa	P2 bypass pilot port
		PCb	P1 bypass pilot port
		PAo1	Option 1 pilot port (A)
		PBo1	Option 1 pilot port (B)
		PAo2	Option 2 pilot port (A)
		PBo2	Option 2 pilot port (B)
PF1/4	3.5~3.9 (25~28)	PL1	Att power boost port
		Dra	Drain port
		Drb	Drain port
		Drc	Drain port
		Drd	Drain port
		PLc1	Boom lock valve release pilot port
		PLc2	Arm lock valve release pilot port
M10	5~6.6 (36~48)	T	Tank port

(2) Specification

Table.4-2

Relief valve	kgf/cm^2 (psi)
Main relief valve set pressure	350 (4980) at 120 L/min (32 gal/min)
Power boost pressure	385 (5470) at 110 L/min (29 gal/min)
Over load relief valve set pressure	
Boom H, Bucket H, Arm R	405 (5760) at 30 L/min (7.9 gal/min)
Boom R, Bucket R, Arm H	385 (5470) at 30 L/min (7.9 gal/min)
OPT1, OPT2 H&R	385 (5470) at 30 L/min (7.9 gal/min)

Fig. 4-1-1 Control valve outside view and hydraulic port