

# Water-Flooded Oil-Free Screw Compressor GP Series

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IHI has developed GP55 (output 55 kW) and GP75 (output 75 kW) of water-flooded oil-free screw compressor GP series and started their sales.

These are the first large twin screw-type compressors of 55 kW or larger lubricated with water without using lubricating oil in Japan.

The GP series expanded the lineup from 15 kW to 75 kW by starting the sales of “GP55/75” (Fig. 1).

## 1. Outline of GP series

### 1.1 Water-flooded screw compressor

The GP series compressors are classified as water-flooded twin screw compressors. The twin screw type compressor is classified into an oil-flooded compressor that injects oil into the compression chamber (hereinafter called air end) and an oil-free screw compressor that does not use oil. The oil-free screw compressor is further classified into a water-flooded screw compressor that injects water into the air end and a dry screw compressor that does not inject water or oil into the air end.

The dry screw compressor and oil-flooded screw compressor have the following disadvantages.

The dry screw compressor cannot seal rotor gaps with water or oil because it does not inject water or oil into the air end. To minimize the leak of compressed air, therefore, it is necessary to rotate the rotor at a high

speed, thus increasing the noise value. Since there is nothing to cool the compressed air in the compression stroke, the discharge temperature of a single-stage compression type reaches 300°C or higher, and the power required for compressing increases. A 2-stage compression type capable of lowering the discharge temperature to about 200°C improves the efficiency, but its structure result in high cost.

With the oil-flooded screw compressor, low-speed rotation becomes possible because the rotor gaps can be sealed with oil injected into the air end. Since the compressed air is cooled by oil in the compression stroke, sufficient efficiency can be obtained even through the single-stage compression and it is simple in mechanism. But since it uses oil, it is troublesome and costly to maintain and requires environmental measures.

Since the GP series (water-flooded oil-free screw compressor) injects water into the air end in place of oil, it removes such disadvantages of the dry screw type and oil-flooded screw type.

### 1.2 Features of GP series

The features of the GP series are cited below.

#### (1) Environment-friendly

The GP series uses water for cooling and lubricating the air end and does not use oil at all. For this reason, it is free from oil mist, oil odor,



Fig. 1 Water-flooded oil-free screw compressor GP series

and oil contamination and can maintain a clean environment.

Since the discharged air does not contain oil, it can supply clean compressed air. Since no oil-removal filter is required, waste produced during maintenance can be reduced, thus reducing the environmental load.

(2) Energy-saving (high efficiency)

As aforementioned, the GP series injects water into the air end. The injected water is discharged from the air end into the tank, then cooled by the water cooler, and injected again into the air end (Fig. 2). Cooling the water (hereinafter called circulating water) efficiently realizes almost isothermal compression of suction temperature +20°C at the outlet of the air end where the pressure increases from the atmospheric pressure to 0.69 MPa. Since the circulating water seals the rotor gaps, leakage of compressed air from the gaps is reduced, thus improving efficiency. Since the sealing effect of the circulating water minimizes the leakage even when the number of revolutions of the rotor is reduced,

the discharged air capacity can be changed from 100% to 30% with use of the inverter control. This makes it possible to cope with a wide range of load fluctuation.

(3) Maintenance-saving

Since the rotor speed is low, the speed increasing gear unit found with the dry screw compressor requiring high-speed revolution is no more required. Since it is of single-stage compression type, its structure is very simple and the number of its parts is small.

Since the discharged air does not contain oil, the oil-removal filter is not required, and such treatment as oil/water separating of the drain, one of disadvantages of the oil-flooded screw compressor, is also not required, reducing the maintenance cost.

(4) Atmospheric moisture utilization system

With the water-flooded screw compressor, such troubles as slime production and scale accumulation occur if the quality of the circulating water deteriorates, and therefore, water quality control is an important element. Conventionally, the water

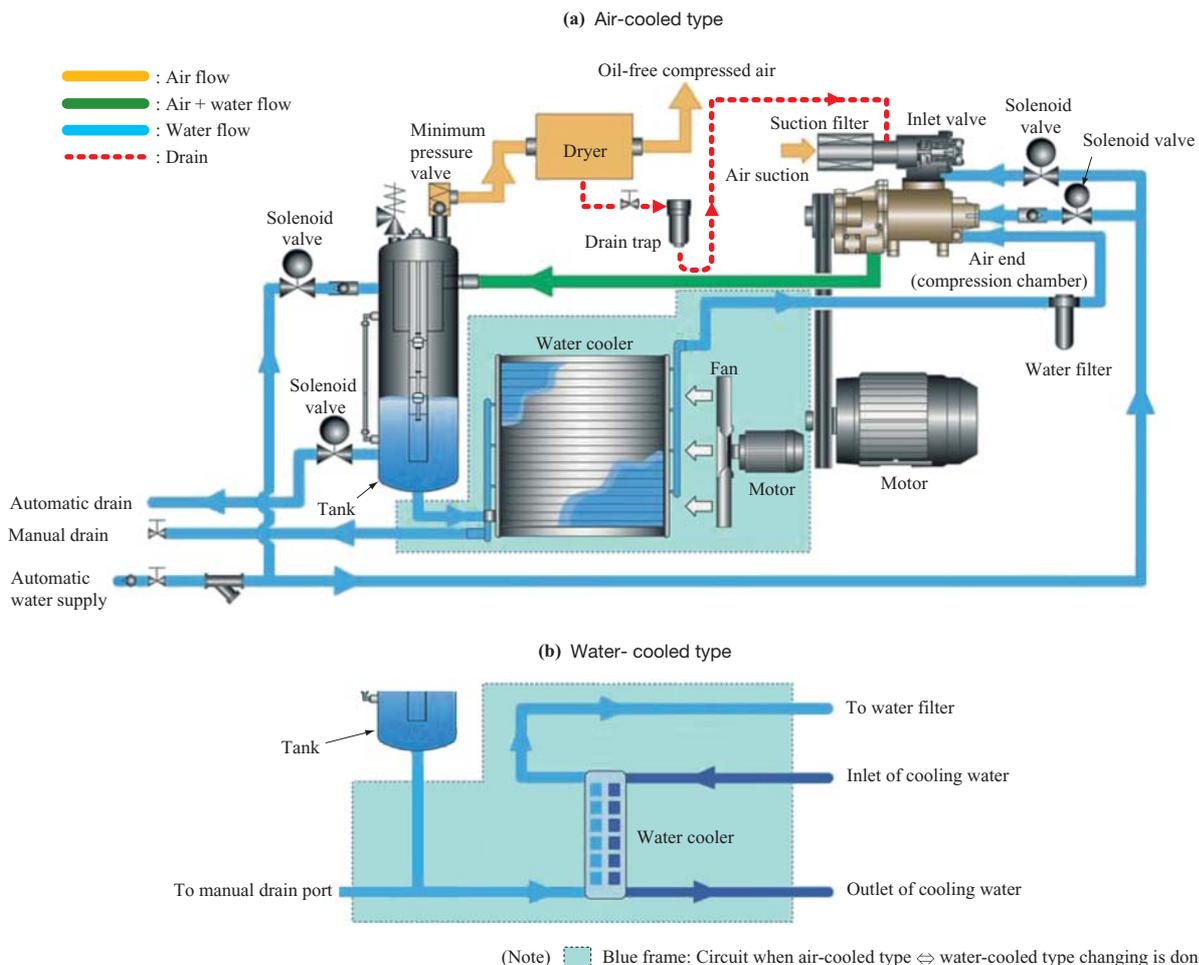


Fig. 2 Flow Sheet

quality has been maintained by installing such water treatment equipment as deionizer and frequently changing the circulating water. In this method, however, the users are burdened with water quality control, including maintenance of the deionizer and the trouble of water changing.

The GP series is equipped with “atmospheric moisture utilization system (IHI patent)” that makes the quality control of circulating water possible by just filling ordinary fresh water at the beginning of operation. Paying attention to the fact that the condensed water (hereinafter called drain) of atmospheric moisture obtained from the built-in air dryer is similar in quality to that of purified

water, the atmospheric moisture utilization system maintains the quality of the circulating water by recirculating water heretofore discharged outside the compressor back into the compressor. With this system, such special equipment as a deionizer is not required and it is enough to change water about once a month, thus reducing the burden of maintenance for the user, and since the circulating water is always replenished by the drain, water supply from outside the compressor can be minimized.

## 2. Specifications

Table 1 shows the specifications of the GP series.

Table 1 Specifications of GP Series

(a) Inverter type

Item		Unit	Specification						
Type		—	GP15BSA-DV	GP22BSA-DV	GP37BSA-DV	GP37BS-DV	GP55BS-DV	GP75BS-DV	
Capacity *1		m <sup>3</sup> /min	0.7 - 2.3	1.0 - 3.5	1.8 - 6.1		2.8 - 9.2	3.8 - 12.7	
Discharge pressure *2		MPa (G)	0.49 - 0.88						
Cooling method		—	Air-cooled			Water-cooled			
Suction condition		—	2 - 40°C (atmospheric pressure)						
Power supply	Frequency	Hz	50/60						
	Voltage	V	200/200·220 (option : 400/400·440)						
Motor	Type · specification	—	3-phases totally enclosed fan cooled induction motor · 4P · insulation class F						
	Nominal output	kW	15	22	37		55	75	
	Starting method	—	Inverter						
Built-in dryer	Refrigerant	—	R407C						
	Output air dew point	°C	10 (under pressure)						
Outside dimensions		mm	1 735 (W) × 1 030 (D) × 1 450 (H)		2 010 (W) × 1 186 (D) × 1 450 (H)		2 110 (W) × 1 310 (D) × 1 740 (H)		

(b) Load/unload type

Item		Unit	Specification						
Type		—	GP15BSA-D	GP22BSA-D	GP37BSA-D	GP37BS-D	GP55BS-D	GP75BS-D	
Capacity *3		m <sup>3</sup> /min	2.3 (1.8)	3.5 (2.7)	6.1 (4.9)		9.2 (7.0)	12.7 (10.3)	
Discharge pressure		MPa (G)	0.69 ( 0.88 )						
Cooling method		—	Air-cooled			Water-cooled			
Suction condition		—	2 - 40°C (atmospheric pressure)						
Power supply	Frequency	Hz	50/60						
	Voltage	V	200/200·220 (option : 400/400·440)						
Motor	Type · specification	—	3-phases totally enclosed fan cooled induction motor · 4P · insulation class F						
	Nominal output	kW	15	22	37		55	75	
	Starting method	—	DOL	Star-delta					
Built-in dryer	Refrigerant	—	R407C						
	Output air dew point	°C	10 (under pressure)						
Outside dimensions		mm	1 735 (W) × 1 030 (D) × 1 450 (H)		2 010 (W) × 1 186 (D) × 1 450 (H)		2 110 (W) × 1 310 (D) × 1 740 (H)		

(Note) \*1: Capacity when discharge pressure is set at 0.69 MPa (G) or less.  
 \*2: Discharge pressure is set at 0.69 MPa (G) when shipped from factory.  
 \*3: Figures in parentheses indicate capacity at discharge pressure 0.88 MPa (G) (option).

### **3. Conclusion**

The water-flooded oil-free screw compressor GP series saves energy and reduces maintenance and environmental load, removing various disadvantages

found with the conventional compressors. The GP55/75 now being marketed can better meet customers' needs. IHI, a general manufacturer of oil-free compressors, will further expand its compressor business by means of the GP series.