粘度コントロールユニット

UNIT OF VISCOSITY CONTROL (TYPE VCU)

AC重油切換弁

D/H OIL CHANGE-OVER VALVE (TYPE EXV･AXV)

SOx対応

SAGInoMIYA

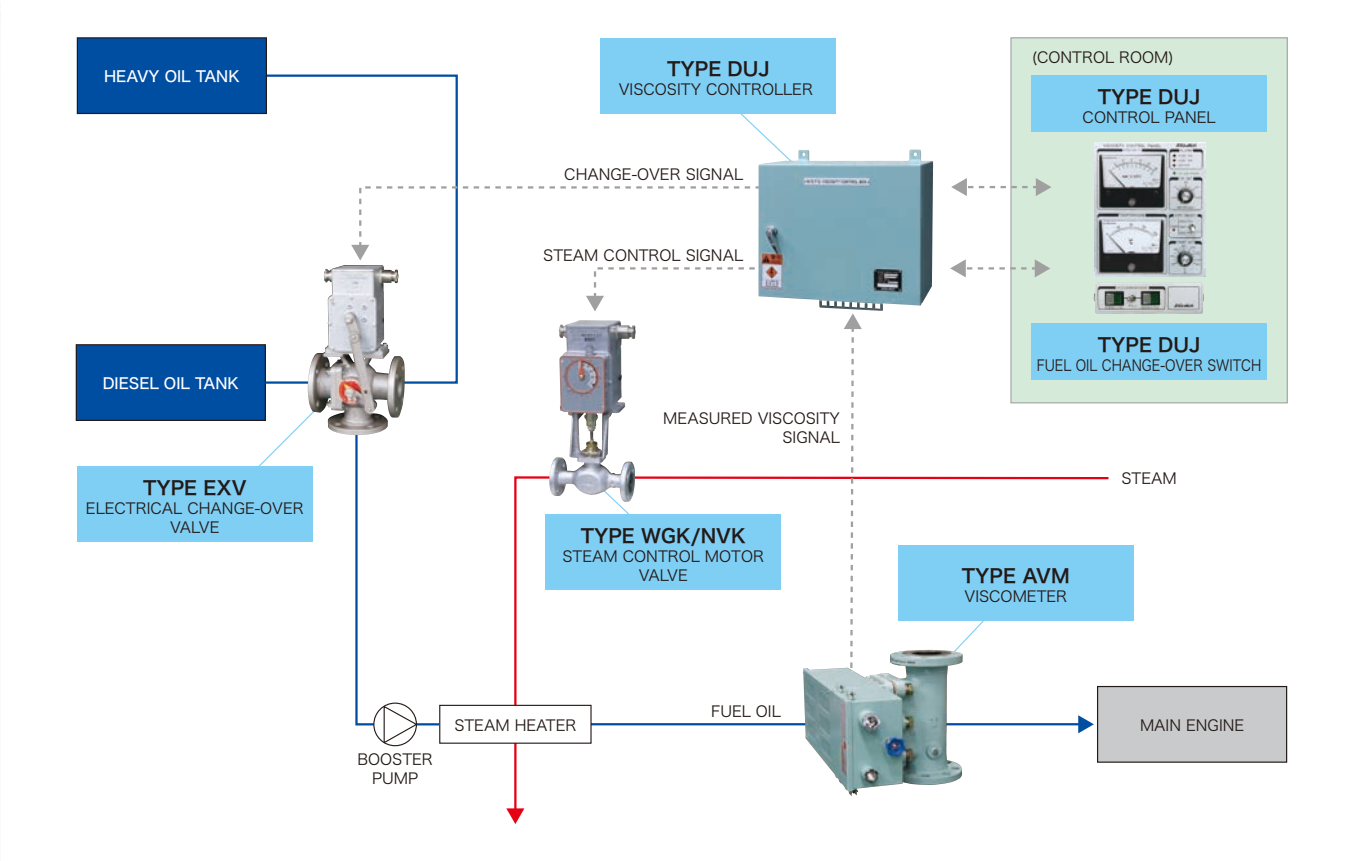
燃料油の粘度管理に威力を発揮
The Excellent Viscosity Control of Fuel Oil

粘度コントロールユニット（VCU形）は粘度センサ（AVM形）、粘度コントローラ（DUJ形）、蒸気制御弁（WGK/NVK形）から構成されております。

いずれもサギノミヤの長年にわたる技術蓄積に依り開発したものです。低粘度から高粘度の幅広い粘度に対し、高信頼性、高精度を誇り、システムの簡素化、取扱い及び保守管理の容易性を考慮して設計されております。

Unit of Viscosily Control (Type VCU) consists of Type AVM Viscometer (Viscosity Sensor), Type DUJ Viscosity Controller and Type WGK/NVK Steam Control Motor Valve. All of the above components have been developed through Saginomiya's technology amassed in many years. It assures high reliability and accuracy and is designed for both simplification of system and easing of maintenance services.

■SYSTEM OUTLINE



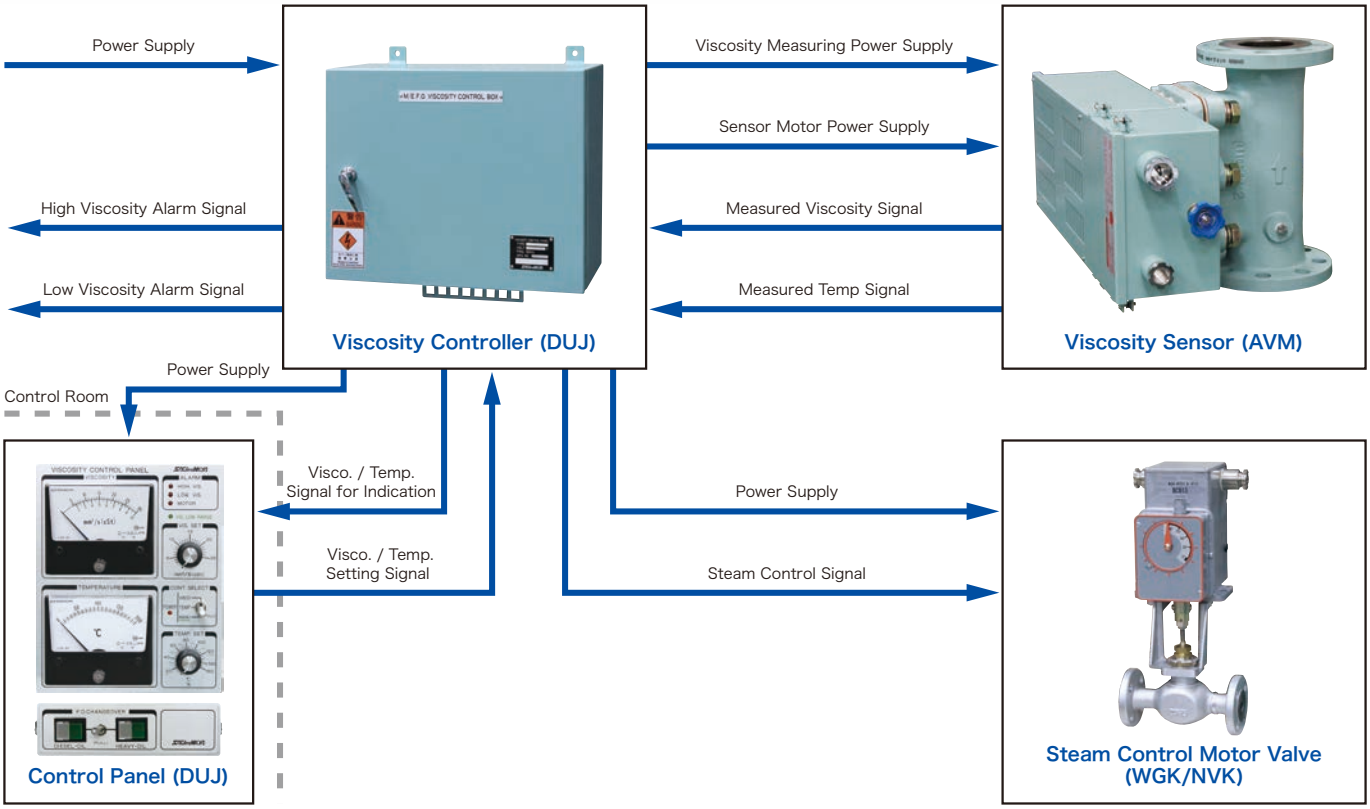
Type DUJ Viscosity Controller	Type AVM Viscometer (Viscosity Sensor)	Steam Control Motor Valve
		
		Combination of Type WGK and Type NVK

■粘度コントロールユニットの概要

インラインに設けた粘度センサで粘度を計測し、DC0～200mVの電気信号を粘度コントローラに送ります。粘度コントローラは粘度信号と設定値を比較し、その偏差に応じた信号を蒸気制御弁又は電気ヒータに送り粘度の制御を行います。
蒸気制御弁及び電気ヒータコントローラ（オプション）への制御信号はDC4～20mAです。
電気ヒータの制御は位相制御方式ですので、滑らかな電力調整が行えます。

■GENERAL DESCRIPTION

The Viscometer (Viscosity Sensor) mounted on a line measures the Value of the Viscosity. It is converted into Electric Signal of 0 to 200mV. DC. for the transmission to the Viscosity Controller. The Viscosity Controller compares the Viscosity Signal with the Set Value, and sends a viscosity control signal to the Steam Control Valve or the Electric Heater in accordance with the difference between the detected viscosity and the set value. The control signal to the Steam Control Motor Valve and the Electric Heater Controller (Option) in 4 to 20mA. DC. Phase control method of the Heater promises a smooth and delicate adjustment of electric power.



●粘度センサ（AVM形）

細管差圧方式の原理を応用しています。細管は高粘度燃料を考慮して材質、太さ、長さ等を充分吟味し、そして差圧検出には半導体式差圧センサを使用しておりますので計測の誤差はほとんどありません。

●粘度コントローラ（DUJ形）

取扱いの容易性を図った設計で、各種の設定及び操作が容易に行えます。制御精度の向上を図るため電子制御パネル（リモートコントロールパネル）で構成され、積分効果など装置の特性に合わせ、安定した制御条件を選定できます。

●蒸気制御弁（WGK/NVK形）

各分野に広く使用されている弁で豊富なサイズを取り揃えてあります。コントロールモータ（WGK形）と弁（NVK形）で構成されております。

●TYPE AVM VISCOMETER (VISCOSITY SENSOR)

Principle of tube differential pressure theory is applied to this sensor. Use of thoroughly proven material, diameter and length of the tube to cope with high viscosity fuel oil, and semi-conductor detecting element eliminate viscosioy measuring error.

●TYPE DUJ VISCOSITY CONTROLLER

The controller features simple handling, i.e. various settings and operations are easily done. To get improved control accuracy, it adopts electronic control system. Most suitable control mode like integral control effect is selectable for each Engine Fuel System.

●TYPE WGK/NVK STEAM CONTROL MOTOR VALVE

A Control Valve consisting of Control Motor (Type WGK) and Valve (Type NVK) is widely used in various fields and available in ample sizes.

粘度の検出原理
DETECTING PRINCIPLE OF VISCOSITY

右図のように内径（D）が一様な細管内を層流条件で粘性流体を流すと、粘性により差圧（⊿P）が発生します。細管の長さ（ℓ）及び流量（Q）を一定にすると、粘度（μ）と差圧（⊿P）は比例関係になります。
（Hagen-Poiseuilleの法則）

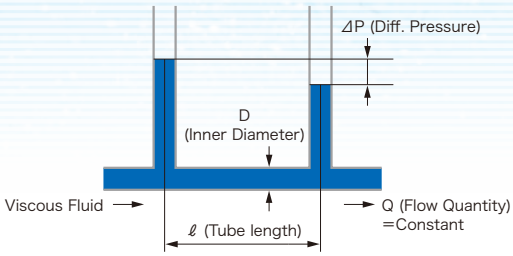
$\mu = A \cdot \Delta P$〔cP〕　ただし　$A = \frac{\pi D^4}{128Q\ell}$

流量〔Q〕は定流量ポンプにより一定に保持されています。

When a viscous fluid flows in a laminas condition of uniformed diameter (D), pressure difference (⊿P) will be created (See the Figure left). When tube length (ℓ) and flow amount (Q) are constant, the viscosity (μ) and pressure differential (⊿P) will be in proportional relation. (Hagen-poiseuille law)

$\mu = A \cdot \Delta P$ (cP)　　Where $A = \frac{\pi D^4}{128Q\ell}$

Flow amount (Q) is kept constant by a pump of constant flow rate.

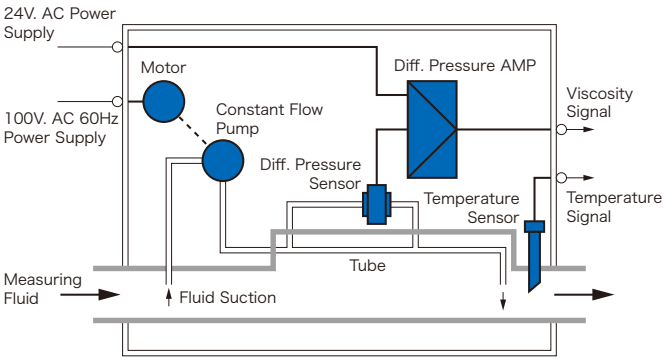


●粘度センサの構成

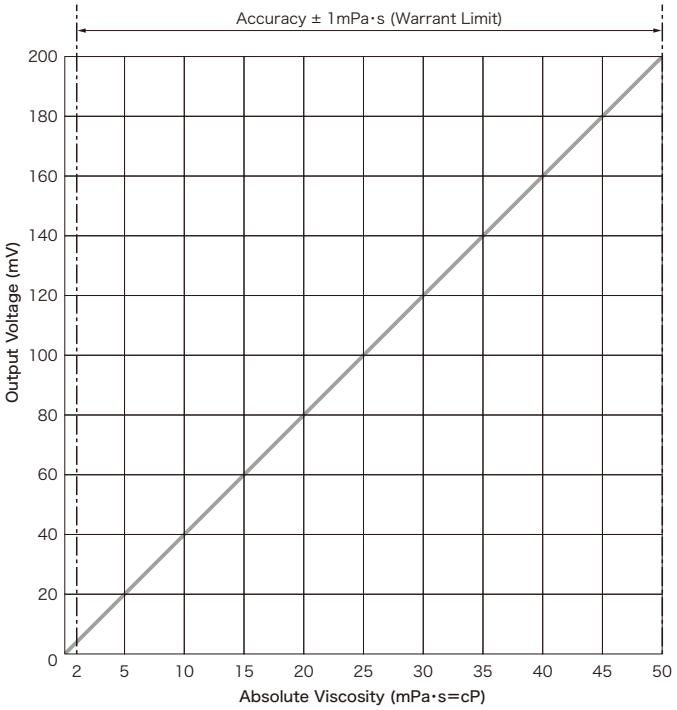
右図は粘度センサの構成を示したものです。細管に生ずる差圧（⊿P）を差圧センサで検出し、それを電子回路で演算して、最終的にDC0～200mVの電気信号として出力させます。

●VISCOMETER (VISCOSITY SENSOR) STRUCTURE

The Figure right presents the structure of a Viscometer (Sensor). The Pressure Difference (⊿P) developed in the tube is detected by semiconductor sensor and computed by an electronic circuit to be sent as electric signal of 0 to 200mV. DC.



●粘度――出力電圧特性
VISCOSITY-OUTPUT VOLTAGE CHARACTERISTIC CHART



●粘度換算表
VISCOSITY CONVERSION TABLE

The numerals below of mm^2/s
are obtained at Fuel Oil Gravity of 0.9

cP	5	10	17	20	30	40	45	50
mm^2/s	5.6	11.1	18.9	22.2	33.3	44.4	50.0	55.6

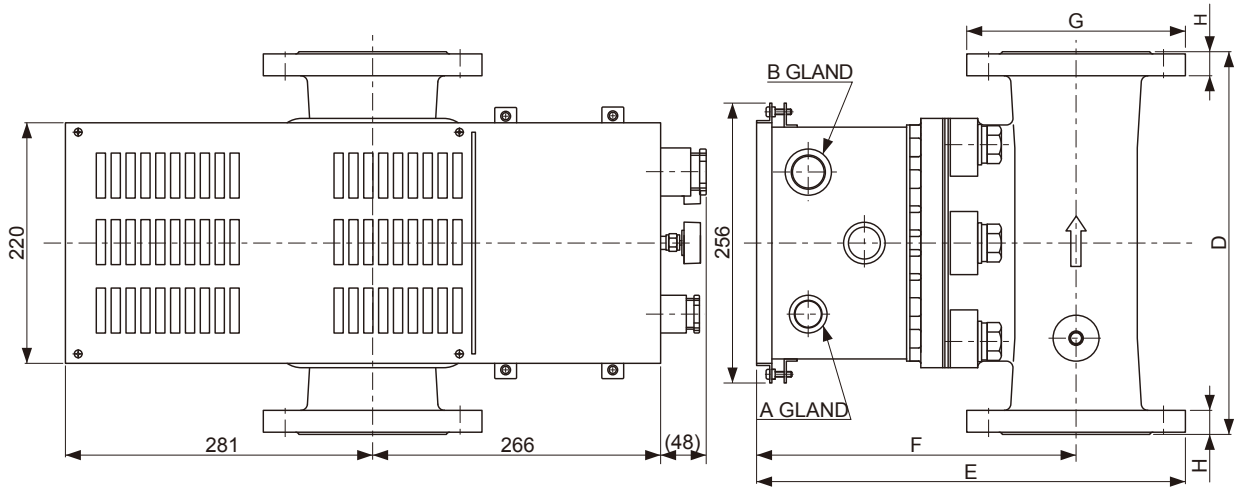
cP : Centipoise＝mPa·s (Absoulte Viscosity)
mm^2/s (Kinematic Viscosity)

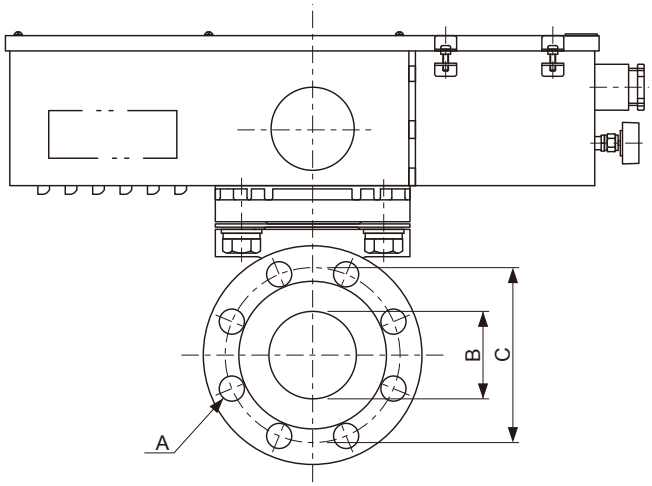
TYPE AVM VISCOMETER (VISCOSITY SENSOR)

●仕様　SPECIFICATIONS

TYPE NUMBER		AVM-0160A10 (AVM-0160A11)	AVM-0160A82 (AVM-0160A52)
CONNECTION		Flange JIS B2239 Nominal 80, 16K (50, 10K)	Flange JIS B2239 Nominal 80 (50), 20K
INSTALLING POSITION		Horizontal and Vertical	
MEASURING FLUID		Fuel Oil (600mm^2/s at 50℃)	
VISCOSITY MEASURING RANGE		1 to 50cP	
ACCURACY		At 2 to 50cP ± 1cP	
VISCOSITY OUTPUT SIGNAL		0 to 200mV	
REPEATABILITY		± 1% (of full scale)	
MAX. FLUID TEMP.		150℃	
AMBIENT TEMP.		0 to 55℃	
MAX. WORKING PRESSURE		1MPa	1.6MPa
HYDRO TEST PRESSURE		1.5MPa	2.4MPa
RESPONSE		20 Seconds or less (Time Constant)	
POWER SUPPLY	Motor	100V. AC ± 10% 60Hz	
	Measuring	24V. AC ± 10% 50/60Hz	
PAINT COLOR		Munsell Value 7.5BG 7/2	

●外形寸法図　DIMENSION





●寸法表　DIMENSION TABLE

Size \ Connection	50A	80A
A	4-φ19 Hole (8-φ19 Hole)	8-φ23 Hole (8-φ23 Hole)
B	φ50 (φ50)	φ80 (φ80)
C	φ120 (φ120)	φ160 (φ160)
D	300 (320)	330 (350)
E	325.5 (348.5)	373 (393)
F	248 (271)	273 (293)
G	φ155 (φ155)	φ200 (φ200)
H	16 (18)	20 (22)

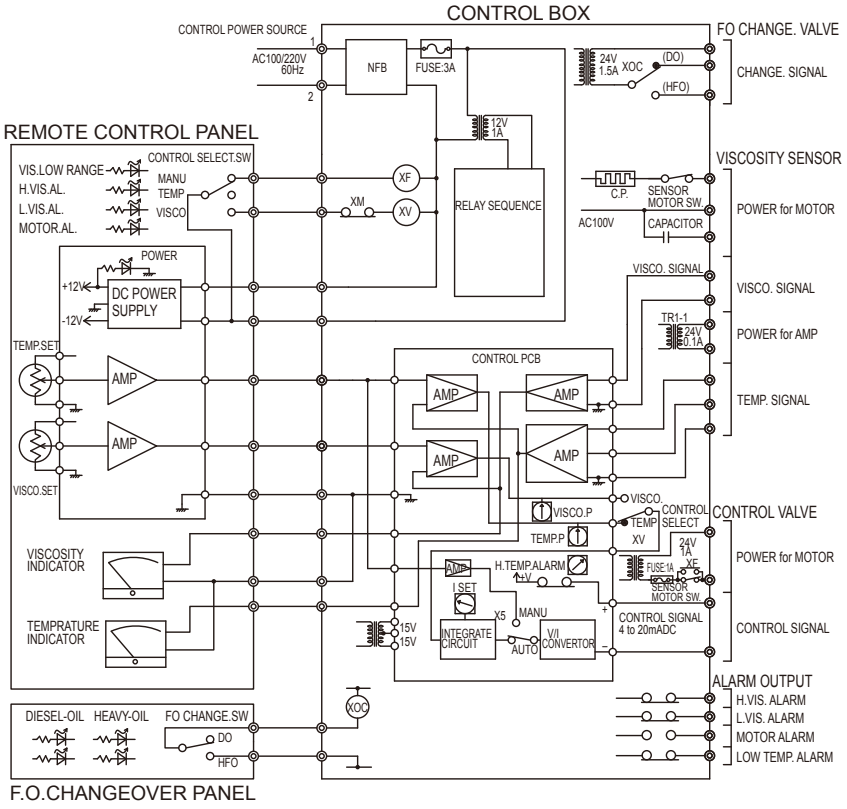
TYPE DUJ VISCOSITY CONTROLLER

●仕様　SPECIFICATIONS

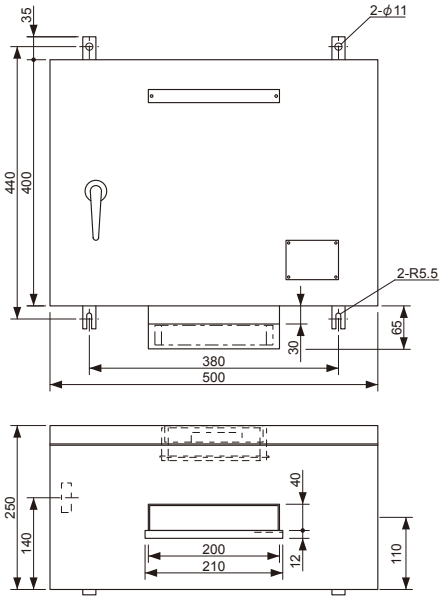
INPUT	VISCOSITY SIGNAL	0 to 200mV (0 to 50cP)	
	TEMPERATURE SIGNAL	PT100Ω Class0.5 3-wire Method	
	CONTROL POWER SUPPLY	Single Phase 100V ± 10% 60Hz Max. 3A	
OUTPUT	VISCOSITY SENSOR MOTOR POWER SUPPLY	100V. AC ± 10% 60Hz Max. 2A	
	VISCOSITY SENSOR MEASURING POWER SUPPLY	24V. AC ± 10% 60Hz Max. 0.1A	
	STEAM CONTROL MOTOR VALVE	Control Motor Power Supply	24V. AC
		Control Signal of Control Motor	4 to 20mA. DC
	HIGH VISCOSITY ALARM	Switches"ON"when Viscosity Value higher than Set Point Value remains for 5min or 30sec Max Contact Capacity-220V. AC 1A (cosϕ=1)	
	LOW VISCOSITY ALARM	Switches"ON"when Viscosity Value lower than Set Point Value remains for 5min or 30sec Max. Contact Capacity-220V. AC 1A (cosϕ=1)	

SETTING RANGE	VISCOSITY	3 to 25mm^2/s
	HIGH VISCOSITY	14 to 26mm^2/s
	LOW VISCOSITY	4 to 16mm^2/s
	PROPORTIONAL BAND	Approx. 2 to 0.5mm^2/s
	INTEGRAL EFFECT	Approx. 0 to 1
DISPLAY	VISCOMETER	1 to 30mm^2/s
	THERMOMETER	0 to 200℃
	LAMP POWER SUPPLY	Lens Color : Amber LED illuminated
	HIGH VISCOSITY LAMP	Lens Color : Red LED illuminated
	LOW VISCOSITY LAMP	Lens Color : Red LED illuminated
OPERATION	SWITCH POWER SUPPLY	Control Power Supply 100V. AC"ON"-"OFF"
	SELECTOR SWITCH	VISCO-TEMP-MANU (Opening)

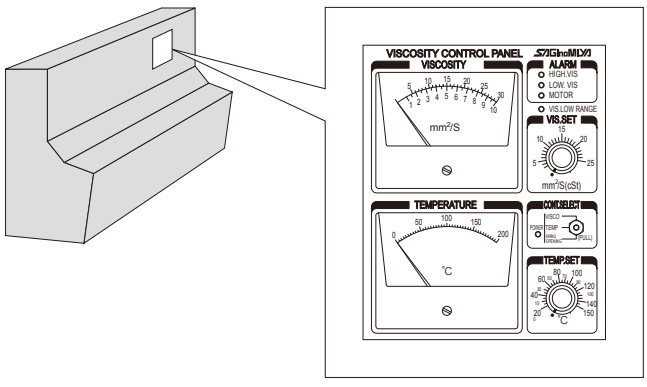
●ブロック図　BLOCK DIAGRAM



●外形寸法図　DIMENSION



●使用例　EXAMPLE OF CONSOLE PANEL



TYPE WGK/NVK STEAM CONTROL MOTOR VALVE

コントロールモータ (WGK-N701A形) と2方弁 (NVK形) の組合わせになります。

It is a combination valve of Control Motor (WGK-N701A) and 2-Way Valve (NVK).

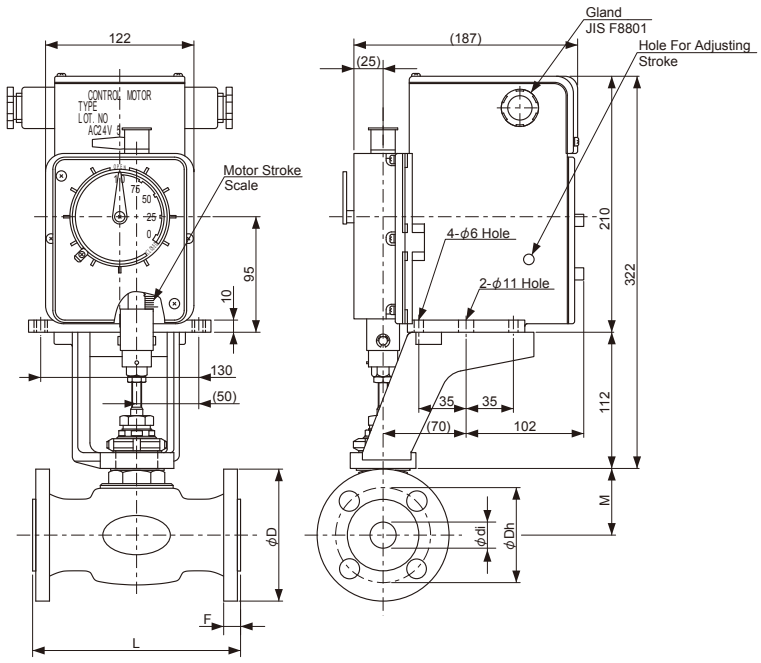
●仕様　SPECIFICATIONS

Control Motor (WGK-N701A)	
Power Supply	24V. AC ± 10% 50/60Hz
Max. Power Consumption	21VA
Input Signal	4 to 20mA. DC
Stroke	20mm
Timing	64 Seconds Stroke 20mm

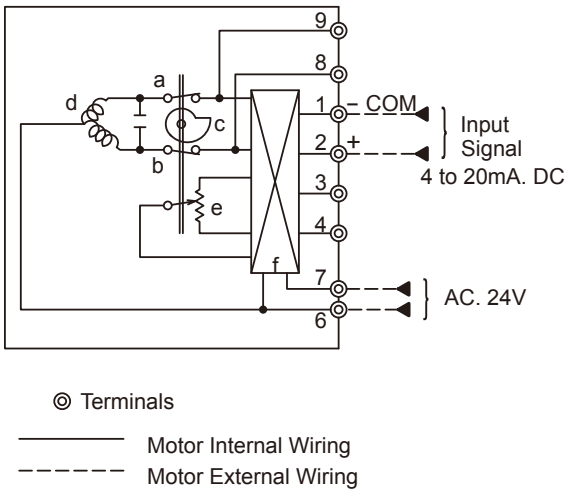
2-Way Valve (NVK Series)	
Connection	Flange (JIS 20K) Nominal 15A to 32A

※詳細資料を用意してあります。別途ご請求ください。
※For more details please contact our office.

●外形寸法図　DIMENSION



●内部結線図　INTERNAL WIRING



◎ Terminals

Motor Internal Wiring

Motor External Wiring

●弁仕様　VALVE SPECIFICATIONS

Catalog No.		Port Size (mm)	Flow Coefficient		Stroke (mm)	Close off Rating (MPa)	Dimensions (mm)						
			Cv	Kv			L	M	D	F	Dh	di	ds
NVK-	1504FP@5	15	1	14.2	20	1.96	190	45	95	14	70	15	4-φ15
	1504FP@6		2.5	35.7									
	1504FP@4		5	71.4									
	2006FP@4	20	8	114.2			194		100	16	75	20	
	2510FP@4	25	12	171.4		1.57	197	50	125		90	25	4-φ19
	3212FP@4	32	20	285.7		0.95	210	53	135	18	100	32	

●蒸気バルブの選定　SELECTION OF STEAM VALVE

(1) The equation of saturated steam.

$$Cv = \frac{0.074 \times W \times 0.098}{\sqrt{\Delta P(P_1+P_2)}}$$

Where: W = Steam flow quantity (kg/h)
P_1 = Inlet pressure (MPaA)
P_2 = Downstream pressure (MPaA)
ΔP = Pressure drop (P_1-P_2)

(2) Example of Calculation

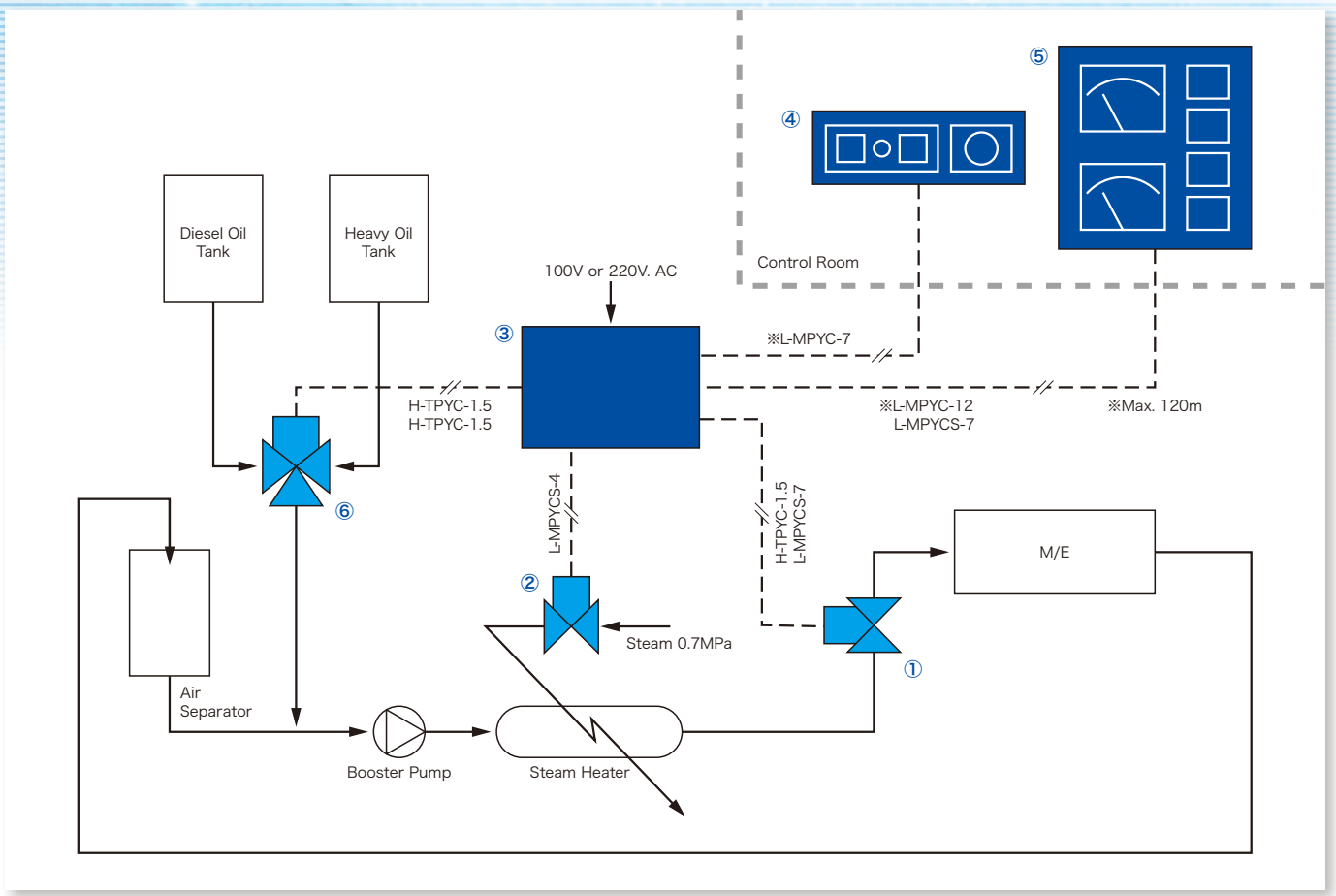
If : W=100kg/h, P_1=0.6MPaA. P_2=0.55MPaA

$$Cv = \frac{0.74 \times 100 \times 0.098}{\sqrt{0.05(0.6+0.55)}} \fallingdotseq 3.0$$

We find the Type valve = NVK-1504FP@4

CONTROL SYSTEM OF MAIN-ENGINE

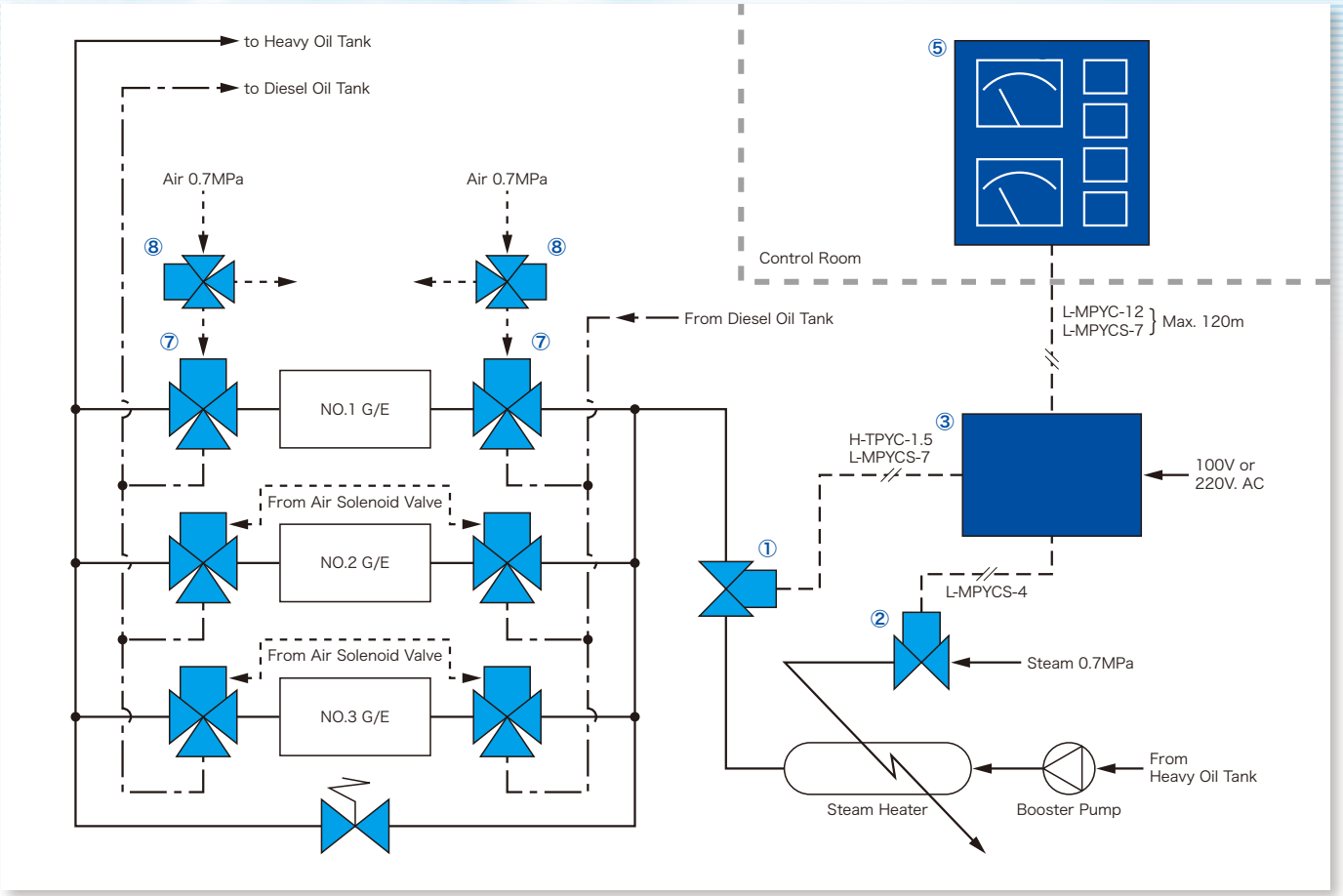
■ENGINE ROOM MOUNTING MODEL WITH CHANGE-OVER FUNCTION



No.	ITEM	TYPE
1	Viscosity Sensor	Type AVM-0160A10, 82 (80A Flange) AVM-0160A11, 52 (50A Flange)
2	Steam Control Motor Valve	Type WGK-N701A/NVK (15A. 20A. 25A. 32A Flange)
3	Viscosity Controller	Type DUJ Control Room Mounting Model or Engine Room Mounting Model.
4	Change-Over and Dimmer Panel	Type DUJ-COMPONENT.
5	Indicator and Control Panel	Type DUJ-COMPONENT.
6	Electrical Change-Over Valve	Type EXV-5020FL (50A Flange) EXV-8030FL (80A Flange)
7	Pneumatic Change-Over Valve	Type AXV-2010FL (25A Flange)
8	3-Way Air Solenoid Valve	Type CMV-C202GQ20 Rc1/4

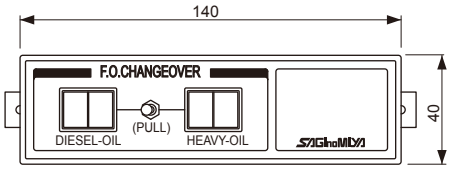
CONTROL SYSTEM OF GENERATOR ENGINE

■ENGINE ROOM MOUNTING MODEL



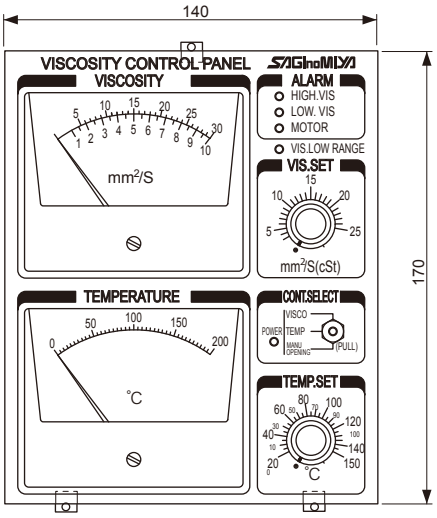
●外形寸法図　DIMENSIONS

Type DUJ-AA11



Depth : 65
Panel Cut Size : 130×30
④Change-Over and Dimmer Panel

Type DUJ-AA22



Depth : 50
Panel Cut Size : 130×160
⑤Indicator and Control Panel

TYPE EXV ELECTRICAL CHANGE-OVER VALVE

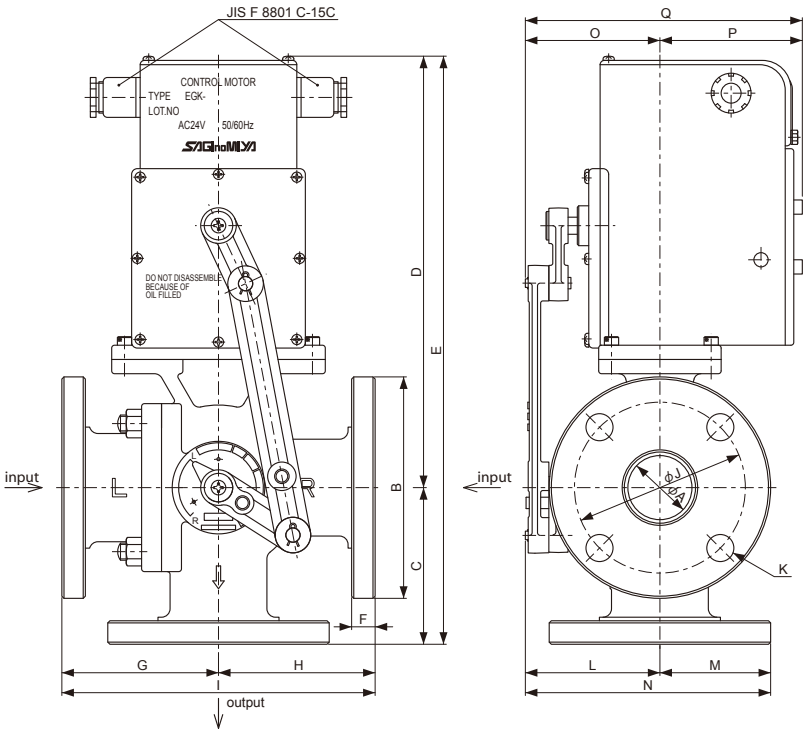
電気式3方切換弁（EXV形）はメインエンジンの燃料系統に取り付けられ、A重油、C重油の切換えに使用されます。
スプリング反力を利用したボール弁構造のため、弁とシートの面圧を一定に保つことができ、安定した弁のしゃ断能力を発揮し、弁の操作力も低く作動が極めてスムーズです。
手動操作機構付
万一、何らかの原因でEXVが作動しなくなった場合、あるいは緊急時に、手動操作により弁のポジションを切換えることができます。

ELECTRICAL CHANGE-OVER VALVE (Type EXV) is for changeover of heavy oil and diesel oil when installed in fuel system of the main engine for the ship. The valve is a ball valve utilizing a spring force and can keep the facial pressure of valve and sheet constant, and gives stable shut-off function. Valve needs minimal operation force assuring very smooth operation.
MANUAL OPERATION
Position of the valve can manually changed in case the valve stops operation or in an emergency.

●仕様　SPECIFICATIONS

TYPE	EXV-5020FL	EXV-8030FL
Connection	JIS B2239 10k 50A Flange	JIS B2239 10k 80A Flange
Hydro Test Pressure	1.5MPa	
Airtight Test Pressure	1MPa	
Max. Working Pressure	0.2MPa	
Fluid	Heavy Oil and Diesel Oil	
Fluid Temp.	0 to 150℃	
Ambient Temp.	0 to 55℃	
Power Supply	24V. AC ± 10% 50/60Hz	
Max. Consumption Power	21VA	
Timing	Approx. 90sec	
Manual Actuator	Mounted	
Position Indicator Switch Contact Capacity	125V. AC……5A	

●外形寸法図　DIMENSION



Catalog No.	EXV-5020FL	EXV-8030FL
JIS 10k Flange	2B	3B
A	50	80
B	155	185
C	110	130
D	303	327
E	413	457
F	16	18
G	110	130
H	110	130
I	220	260
J	120	150
K	4-φ19	8-φ19
L	96	123
M	77.5	92.5
N	173.5	215.5
O	96	123
P	102	75
Q	198	198

TYPE AXV PNEUMATIC CHANGE-OVER VALVE

空気式３方切換弁（AXV形）は発電機エンジンの燃料系統に取り付けられA重油、C重油の切換えに使用されます。
スプリング反力を利用したボール弁構造により、弁とシートの面圧を一定に保つことができ、安定した弁のしゃ断能力を発揮します。空気は三方電磁弁（CMV形）によって供給しAXV形を作動させます。
手動操作機構付
何らかの原因で空気供給圧が得られない場合に手動操作により弁のポジションを切換えることができます。

PNEUMATIC CHANGE-OVER VALVE (Type AXV) is used for changeover of heavy oil and diesel oil when installed in fuel system of generator engine for the ship. The ball valve construction with a use of spring force enables the facial pressure of valve and sheet constant. and gives stable shut off function. Air is supplied from 3-way solenoid valve (Type CMV) to actuate Type AXV.
MANUAL OPERATION
Position of the valve can be manually changed in case air supply stops.

●仕様　SPECIFICATIONS

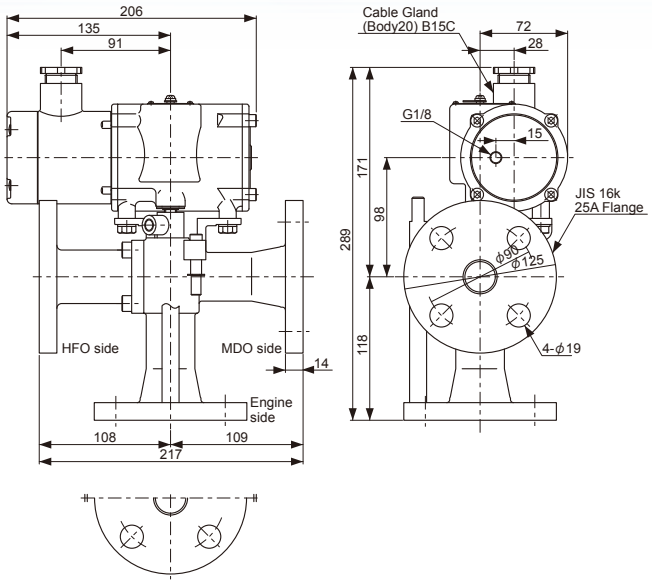
TYPE		AXV-2010FL
VALVE SECTION	Connection	JIS B 2239 16k 25A Flange
	Hydro Test Pressure	2MPa
	Airtight Test Pressure	1MPa
	Max. Working Pressure	1MPa
	Fluid	Heavy oil and Diesel oil
	Fluid Temp.	0 to 150℃
	Ambient Temp.	0 to 55℃
ACTUATOR SECTION	Bursting Pressure	1.5MPa
	Operating Air Pressure	0.5 to 1MPa
	Type Of Fluid	Air. inert gas
	Air Connection	G1/8
	Manual Actuator	Mounted
	Ambient Temp.	0 to 55℃
	Position Indicator Switch Contact Capacity	125V. AC……5A 30V. DC……4A

TYPE	CMV-C202GQ20
Connection	Rc1/4
Hydro Test Pressure	1.8MPa
Airtight Test Pressure	1.2MPa
Working Pressure	0 to 1MPa
Fluid	Air
Fluid Temp.	0 to 65℃
Ambient Temp.	0 to 55℃
Power Supply	110V. AC or 220V. AC 50/60Hz
Power Consumption	9W

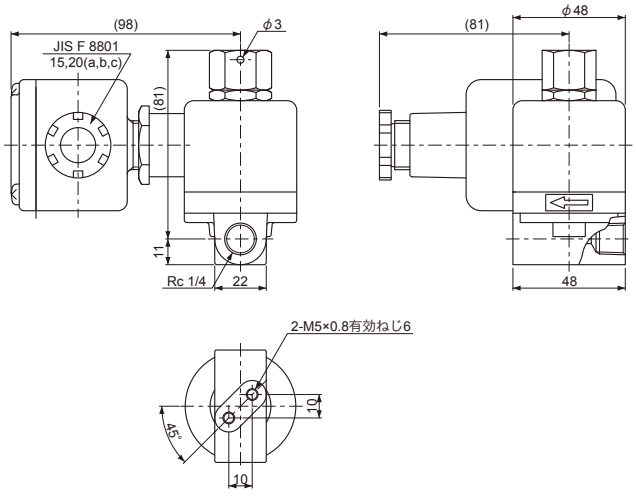
Type AXV

Type CMV

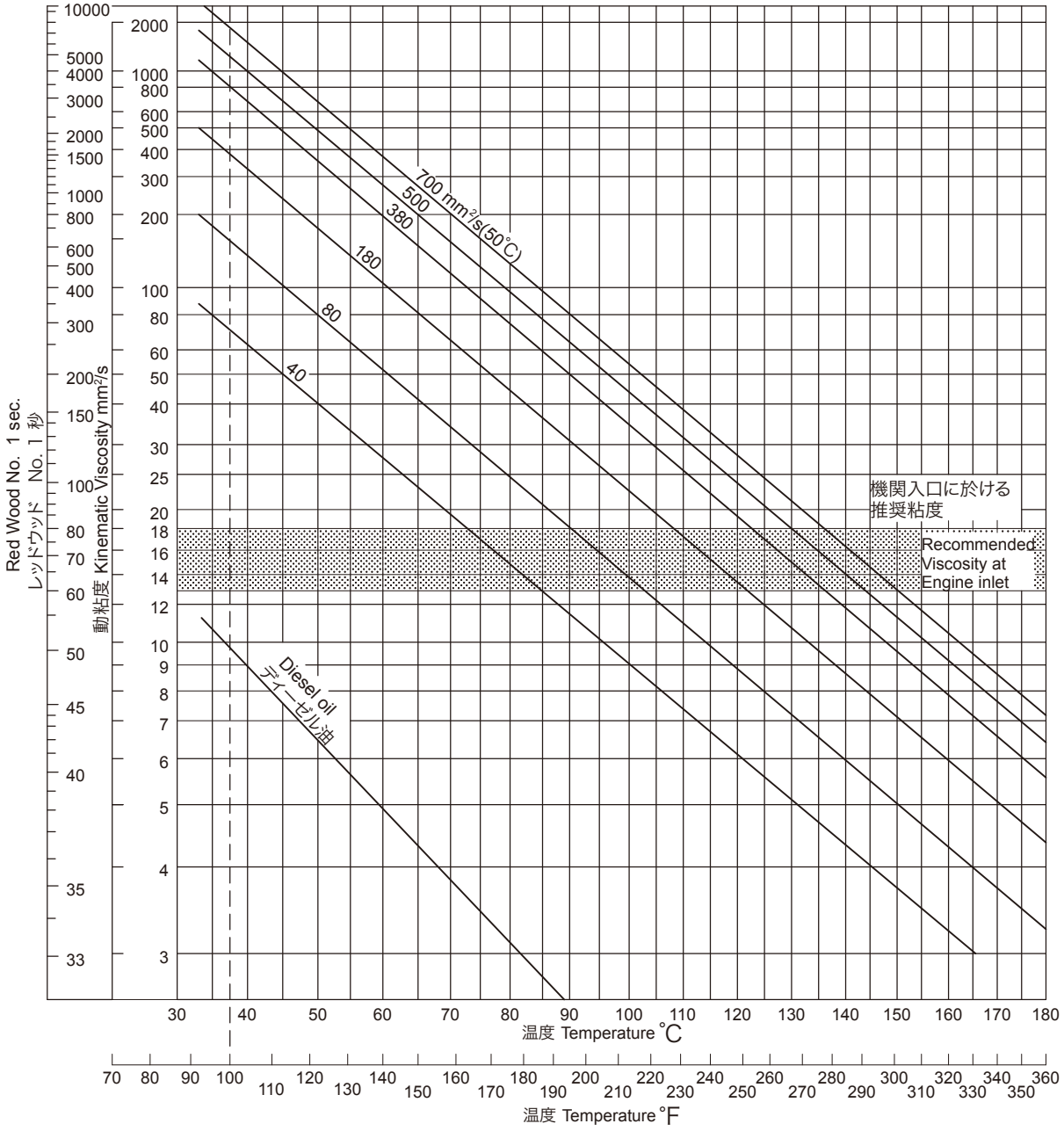
●外形寸法図　DIMENSION (TYPE AXV)



●外形寸法図　DIMENSION (TYPE CMV)



●重油粘度ー温度図表　VISCOSITY-TEMPERATURE CHARTS



安全に関するご注意

NOTES FOR SAFETY

ご使用の前に「取扱説明書」をよくお読みの上、正しくお使いください。
製品改良の為、予告なしに仕様、構造などの変更を行うことがあります。

Failure to read and follow all instruction carefully before installing or operating the product could cause personal injury and/or property damage.
Specifications and structure are subject to change without notice.

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