

## BAB V

### PENUTUP

#### 5.1. KESIMPULAN

Dari hasil perhitungan yang telah dilaksanakan, maka dapat diambil kesimpulan :

1. Untuk menentukan besarnya daya motor induk sebagai penggerak utama kapal, maka faktor kecepatan, jarak pelayaran, serta bentuk dan fungsi dari kapal mempunyai pengaruh yang sangat besar.
2. Tata letak mesin induk dan mesin bantu maupun peralatan lain hendaknya diatur seefisien mungkin, hal ini untuk mempermudah perawatan dan perbaikan peralatan yang ada didalam kamar mesin.
3. Tata letak peralatan permesinan berpengaruh pada stabilitas kapal
4. Pemilihan generator tergantung pada jumlah daya yang harus di suply pada kondisi maksimal
5. Dalam perencanaan kamar mesin, tidak terlepas dari adanya asumsi – asumsi yang diberikan untuk mempermudah perhitungan dengan tidak mengabaikan tanggung jawab secara teknis.

#### 5.2. SARAN – SARAN

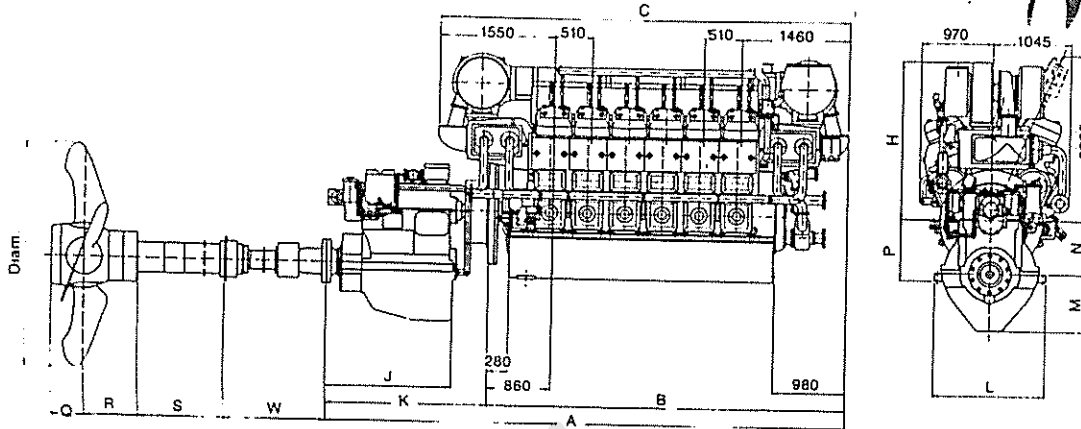
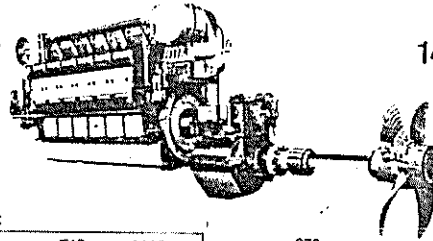
Agar Fakultas maupun Universitas kiranya dapat lebih banyak melengkapi buku – buku referensi untuk mempermudah mahasiswa dalam menjalankan study.



## DAFTAR PUSTAKA

1. Biro Klasifikasi Indonesia (BKI), Volume II, Rules for Hull Construction, 1996
2. Biro Klasifikasi Indonesia (BKI), Volume III, Rules for Machinery Installation, 1996
3. Biro Klasifikasi Indonesia (BKI), Volume IV, Rules for Electrical Installation, 1996
4. J. Klinkert & G.W. White; "Nautical Calculation Explained".
5. Khetagurov, M; "Marine Auxiliary Machinery and System", Peace Publisher Moscow.
6. Pursey, H.J; "Merchant Ship Stability", 1970.
7. Sukarsono, NA.; "Sistem Pipa Dalam Kapal".
8. Suwardi Masrun,Ir, MSc.; "Mesin Bantu Kapal" (Marine Auxiliary Engine).
9. Teguh Sastrodiwongso, Ir,MSE.; "Tahanan dan Propulsi Kapal".
10. Diktat dan buku-buku perkuliahan

Type V28/32A-VO  
2940-3920 kW (4000-5330 bhp)



Standard programme

ENGINE Type Output mcr	REDUCTION GEAR		PROPELLER			Dimensions in mm													
	Series	Type	Type	rpm	Diam. mm	A	B	C	H	J	K	L	M	N	P	Q	R	S	W
																		max.	min.
12V28/32A 2940 kW 4000 bhp	AMG 28	31VO30	VB 860	248	3050	7044	4870	5560	2152	1693	2174	1500	780	700	800	445	745	6600	1350
	AMG 28	39VO30	VB 860	201	3400	7044	4870	5560	2152	1693	2174	1500	780	700	800	445	745	6600	1350
	AMG 28	45VO30	VB 980	171	3700	7044	4870	5560	2152	1693	2174	1500	780	700	800	584	820	7200	1600
	AMG 28	52VO27 <sup>1)</sup>	VB 980	150	3950	7044	4870	5560	2152	1693	2174	1500	780	700	800	584	820	7200	1600
16V28/32A 3920 kW 5330 bhp	AMG 28	31VO30	VB 860	248	3250	8036	5890	6580	2212	1693	2146	1500	780	700	800	445	745	6600	1350
	AMG 40	34VO40	VB 860	231	3350	8516	5890	6580	2212	2155	2626	1840	1050	870	1045	445	745	6600	1350
	AMG 40	42VO40	VB 980	186	3600	8516	5890	6580	2212	2155	2626	1840	1050	870	1045	584	820	7200	1600
	AMG 40	51VO36	VB1080	151	4250	8516	5890	6580	2212	2155	2626	1840	1050	870	1045	800	855	7200	1600

<sup>1)</sup> Lloyd's Register of Shipping require 51VO36

Optional horizontal offset gearboxes (12V28/32A only): Series AMG 20 type 31HO30, 39HO30, 45HO30 and 52HO27

Main data

ENGINE Type	BORE mm	STROKE mm	ENGINE rpm	MEP bar	PISTON SPEED m/s	OUTPUT/CYLINDER	
						kW	bhp
V28/32A	280	320	775	19.3	8.3	245	333

Weight

ENGINE Type	GEAR Type	PROP. Type	Dry weight in tons (approx.)		
			Engine	Gear	Prop.
12V28/32A	31VO30	VB 860	29.5	7.3	7.1
	39VO30	VB 860	29.5	7.3	7.9
	45VO30	VB 980	29.5	7.3	8.8
	52VO27	VB 980	29.5	7.3	8.9
16V28/32A	31VO30	VB 860	37.0	7.3	8.1
	34VO40	VB 860	37.0	13.4	8.2
	42VO40	VB 980	37.0	13.4	10.0
	51VO36	VB1080	37.0	13.4	13.2

\* Weight incl. 4.0 m shaft and 2.0 m stern tube

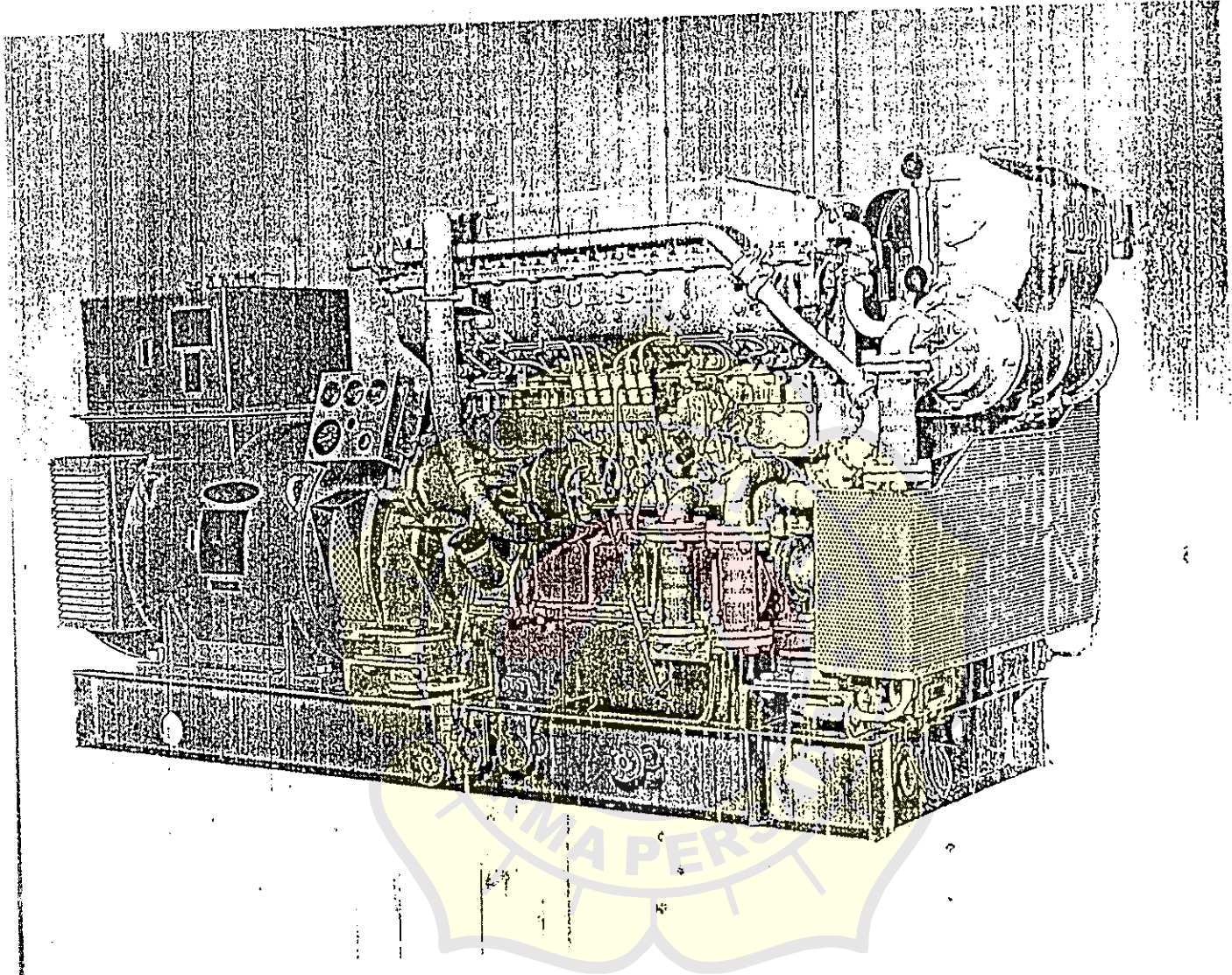
Specific consumption

ENGINE Type	FUEL OIL*				LUBRICATING OIL	
	mcr		90% mcr		mcr	
	g/kWh	g/bhph	g/kWh	g/bhph	g/kWh	g/bhph
V28/32A	193	142	192	141	1.0	0.7

\* Reference conditions page 7

Engines and proposals CPP's and controls L43/54 L46/60 L58/64 CPP's and controls L55/60C-60MC Gearboxes, CPP's and controls L32/40 Control systems CP propellers Reduction gearboxes Four-stroke engines Two-stroke systems

# MITSUBISHI DIESEL ENGINE MARINE GENERATOR UNITS FEG-H SERIES



## Features

- 1. Self-contained & quickly installed**  
Diesel engine and marine generator are mounted on common bed with vibration isolator which eliminates noise, resonance, high-frequency vibrations. Other necessary accessories like heat-exchanger and sea water pump are also attached to engine. Combination of high-speed diesel engine and 4 poles single bearing marine generator is compact enough to install in a small area.
- 2. Low fuel consumption**  
With a direct fuel injection system, well-matched own manufactured turbocharger, diesel engine produces optimum combustion conditions and keeps a low specific fuel consumption.
- 3. Stable voltage regulation**  
AVR ensures a quick electrical response against variations in voltage, power factor and rotating speed.
- 4. Minimum routine maintenance**  
Pump, governor and other accessories have automatic lubricating system. All of sliding parts in a generator is excluded completely.
- 5. Wide applications**  
Many types of engine/generator protection system, parallel running and remote control system are available as option.  
International classification society like ABS, NK grants factory approval for our products.

# Specifications

Units Model			Mitsubishi	FEG180H	FEG215H	FEG250H	FEG300H	FEG350H	FEG375H
Marine Generator	Output	60 Hz	kVA	187.5	215	250	300	350	375
			kW	150	172	200	240	280	300
	50 Hz	kVA	150	187.5	220	250	275	312.5	
		kW	120	150	175	200	220	250	
Type	Drip proof, Brushless, Self excited, with AVR, Self ventilated, Class F insulation, Single bearing, Power factor 0.8 (lagging)								
Voltage (ACV) 3 phase 4 wires	60 Hz		450/260, 440/254						
50 Hz		415/240, 400/230, 390/225, 380/220							
Dry weight	kg		950	1010	1100	1290	1320	1500	
Model	Mitsubishi		S6B-MPT	S6B-MPT	S6B-MPTA	S6B-MPTK	S6A-MPTA	S6A-MPTK	
Type	4 stroke cycle, Water cooled, Turbocharged, Direct injection type, Inline 6 cylinders diesel engine								
Cylinder volume	liter		12.88				15.85		
Output (HP)	1800 rpm	60 Hz	225	260	320	360	425	450	
		50 Hz	180	225	265	300	350	400	
Supercharging system	T		T - Turbocharged, TA - Turbocharged with after cooler						
	TK		TK - Turbocharged with inter cooler						
Direction of rotation	Counterclockwise viewed from generator end								
Dry weight	kg		1150	1150	1200	1200	1730	1730	
Dimensions	Length	mm	2688	2688	2683	2763	2827	2917	
	Width	mm	1020	1020	1020	1020	1085	1085	
	Height	mm	1386	1386	1386	1386	1464	1496	
Dry weight	kg		2270	2340	2500	2700	3280	3530	
D/G Units									

## Standard Accessories

- ☆ Diesel engine
  - Turbocharger with Air silencer
  - Charged air cooler (FEG250H to 375H)
  - Water cooled exhaust manifold
  - Ex. gas flex. pipe
  - Governor (Mechanical type)
  - Fuel feed pump
  - F.O. injection pump (Bosch type)
  - F.O. injection nozzle (Hole type)
  - F.O. filter, secondary
  - L.O. pump
  - L.O. cooler
  - L.O. filter
  - L.O. bypass filter
  - L.O. priming pump (Manual type)
  - Fresh water pump (Centrifugal type)
  - Thermostat valve
  - Sea water pump
  - Heat exchanger
  - Expansion tank
  - Sea water inlet (for emergency)
- Instruments panel  
(Tachometer with Hour meter, L.O. press. gage, Fresh water temp. gage, L.O. temp. gage, Starter key switch)
- Thermometer for ex. gas
- Safety alarm sensor (for low L.O. press. and high water temp.)
- Electric starting motor (DC24V)
- Engine control (Manual type)
- ☆ Marine generator
  - Excitor with AVR
  - Voltage controller
  - Flash button
- ☆ D/G units
  - Common bed
  - Vibration isolator
  - Flex. pipe (for seawater)
  - Std. tool
  - Std. spare parts

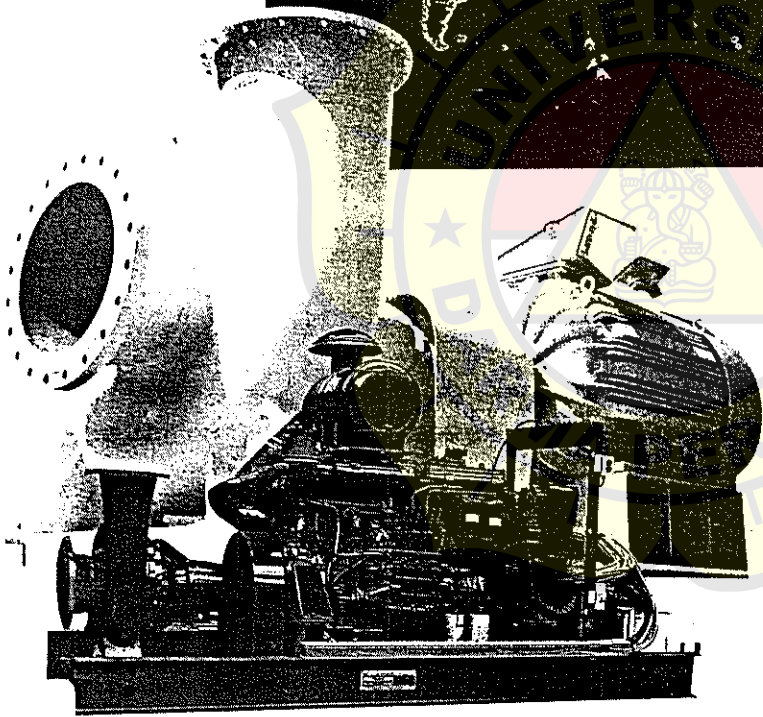
NAME	SYMBOL	NAME	SYMBOL	NAME	SYMBOL	NAME	SYMBOL
STOP VALVE STRAIGHT WAY		AIR VENT PIPE		PERFORATION PIECE			
STOP VALVE ANGLE		AIR VENT PIPE HEAD-FLANGE SCREEN		FLEXIBLE LINE			
NON-RETURN VALVE STRAIGHT WAY		AIR VENT PIPE HEAD V. FIRE NET		REDUCER			
NON-RETURN VALVE ANGLE		AIR VENT PIPE HEAD WITHD. SCREEN		SUCTION BELLMOUTH			
OUTBOARD VALVE SPRING LOADED		GLASS LEVEL GAUGE		EXPANSION JOINT			
FIRE 2 WASHDECK VALVE STRAIGHT		LEVEL GAUGE WITHOUT STOP VALVE		OIL TRAY			
FIRE 2 WASHDECK VALVE ANGLE		LEVEL GAUGE WITH SELF-CLOS. VALVE		AGGREGATE SCOPE OF DELIVERY			
LOCKED VALVE		LEV GAUGE WITH MAGNET TRANSF.		PRESSURE SWITCH			
LOCKED VALVE INNORMAL OPEN		SIGHT GLASS		TEMPERATURE SWITCH			
LOCKED VALVE (NORMAL CLOSED)		LEVEL INDICATOR		LEVEL SWITCH			
VALVE OPEN SEALED		PRESSURE GAUGE		FLOW SWITCH			
VALVE CLOSE SEALED		COMPOUND GAUGE		DIFFERENCE PRESSURE INDICATOR			
BALANCING VALVE		THERMOMETER		LEVEL ALARM LOW			
PRESS. REDUCING VALVE, FLANGED		FLOW METER		LEVEL ALARM HIGH			
RELIEF & SAFETY VALVE		PUMP (ATTACHED MACHINE)		TEMP. ALARM HIGH			
SELF-CLOSING VALVE		HAIRD PUMP, SEMI ROTARY TYPE		TEMP. ALARM LOW			
FOOT VALVE		HAIRD PUMP, PISTON TYPE		TEMP. ALARM SPEED REDUCTION			
FOOT VALVE WITH STRAINER		EJECTOR		PRESSURE ALARM LOW			
QUICK CLOSING V. AIR OPERAT I		SHIPLEX STRAINER		PRESSURE ALARM SHUT-DOWN			
QUICK CLOSING V. HYDR. OPERAT I		DOUPLEX STRAINER		PRESSURE CONTROL			
PNEUMATIC PISTON VALVE		Y-TYPE STRAINER		TEMPERATURE CONTROL			
PNEUMATIC CHANGE-OVER VALVE		NUD BOX		LEVEL CONTROL			
CHANGE-OVER VALVE		SCUPPER, WATER SEAL, ROSE PLATE		EMERGENCY SHUT-DOWN			
DIAPHRAGM VALVE		SCUPPER, NON V. SEAL, ROSE PLATE		AUTOMATIC START			
VAX TYPE TEMP. CONT. VALVE		SCUPPER, NON V. SEAL, ROSE PL.		AUTOMATIC STOP			
INDIC. REGULATING VALVE		STEAM OR AIR TRAP		AUTOMATIC START, STOP WITH ELECTRIC HEATER			
CONJ. SUCTION VALVE CHECKS		T - PIECE (FLANGE END)		BALLAST LINE			
SUCTION/DISCHARGE VALVE CHECKS		T - PIECE (SCREW END)		FIRE FIGHTING LINE			
STOP VALVE (SCREW END)		SPECTACLE FLANGE		FIRE FIGHT L. OUTSIDE ENG. ROOM			
STOP VALVE ANGLE (SCREW END)		HOPPER					

# HORIZONTAL SPLIT CASING

→ vertical

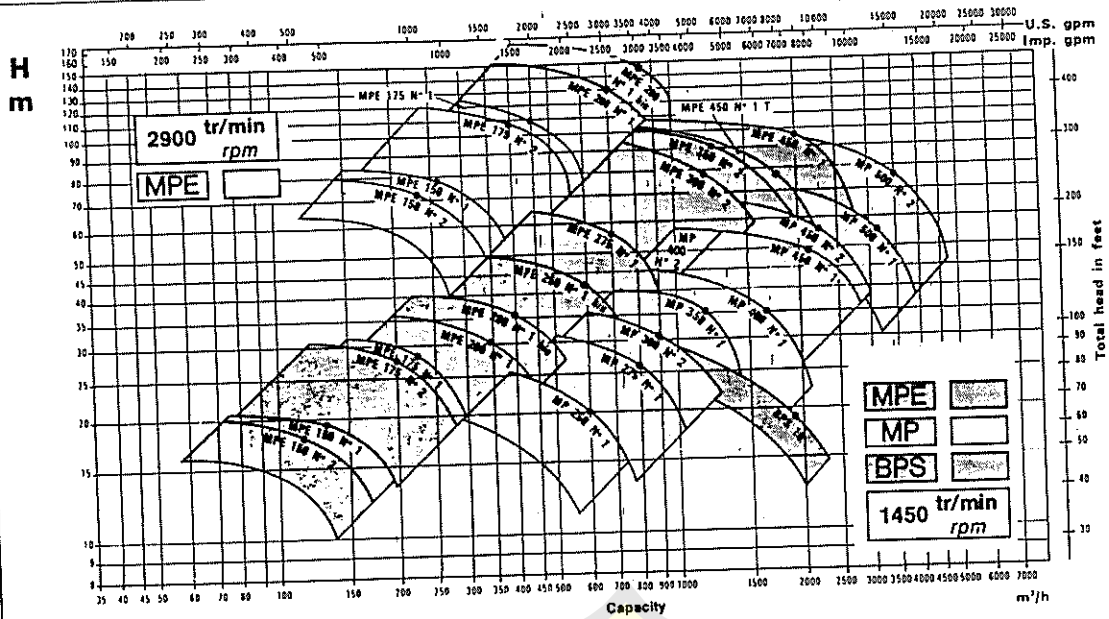


**MEET  
NFPA - 20  
standard**

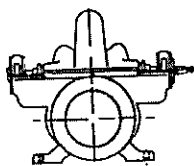
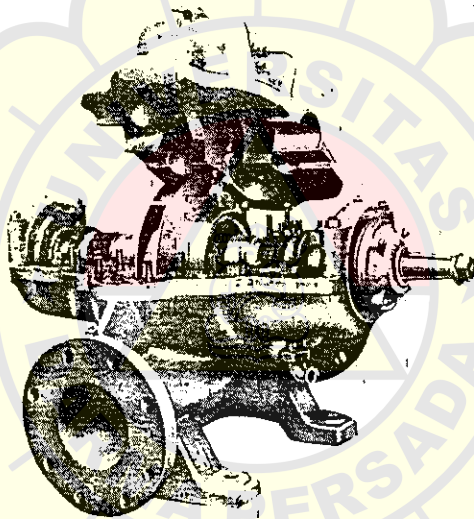


**Ingersoll-Dresser Pumps**

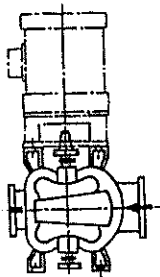
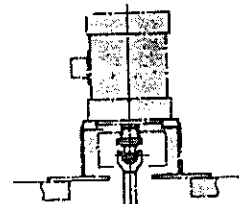
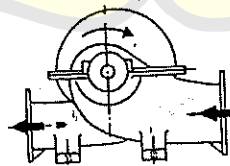




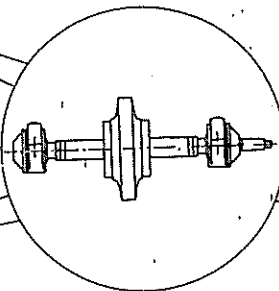
**MP**  
**MPE**  
**BPS**



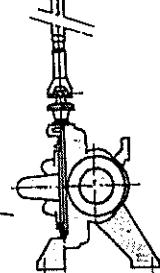
MP - MPE  
BPS



MP - V  
MPE - V  
BPS - V



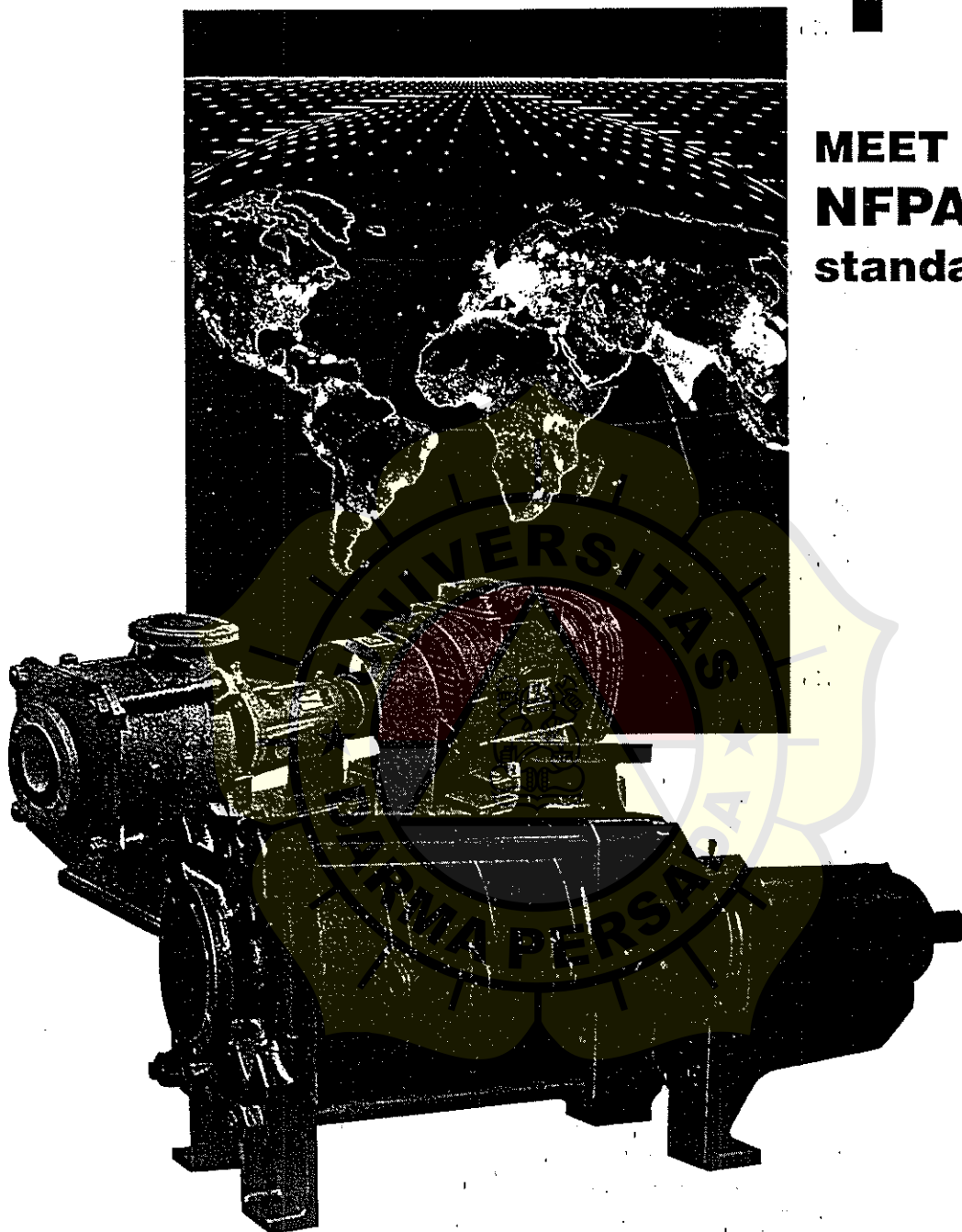
MP - Y  
MPE - Y  
BPS - Y



# Multistage Centrifugal Pumps

# F

**MEET  
NFPA - 20  
standard**



# ID

**Ingersoll-Dresser Pumps**

**Construction**

Centrifugal multistage and electro-pump sets, working pressure 25 bar, designed for pumping cold water and any clear liquid compatible with the material components.

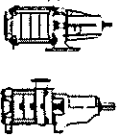






This range includes 7 pump sizes of modular construction having suction diameters of 50, 65, 80, 100, 125, 152, 202 ; 2 hydraulics per size (E = low capacity ; L = large capacity) for the sizes 50, 65, 80, 125, 152, 202 ; and 1 hydraulic for the size 100.

The high hydraulic efficiency and the high suction lift are the main features of these pumps.

The reduced number of components for the wide range of coverage and the numerous possibilities of installation make maintenance easier and result in substantial savings due to reduced spare parts currently required.

Since there are no bearings within the pump end (FP, FM, FMD) the pumping of slightly abrasive liquids is possible without any degradation of the shaft regardless of the degree of wear on the hydraulic components.

The shaft is sleeved under the seal.

Pump definition			speed min <sup>-1</sup>	number of stages - maximum						
				50	65	80	100	125	152	202
	FP	Horizontal overhung bearing pump with common pedestal support for pump and bearing to 125 and bearing housing pedestal supported for 152-202. Axial suction, grease lubricated, ball bearing, belt and pulley drive are possible on request.	1450	7	7	6	5	5	4	4
			2900	7	6	5	5	5		
	FD	Vertical pump, side suction in the soleplate, lateral discharge. Thrust bearing with grease lubricated ball bearing, semi flexible coupling between the motor shaft and the coupling shaft with automatic alignment.	1450	7	7	6	5	5	4*	4*
			2900	7	6	5	3			
	FAH	Horizontal close coupled electrical pump set with rigid detachable coupling, axial suction, robust construction, common pedestal support. Squirrel cage drip-proof motor with heavy duty grease lubricated bearings.	1450							
			2900			5	3			
	FAD	Vertical close coupled electrical pump set with rigid detachable coupling. Lateral suction in the fixing base. Reduced floor-space. Squirrel cage drip-proof motor with heavy duty grease lubricated bearings.	1450						4*	4*
			2900		6	5	4	1		
	FM	Horizontal close coupled electrical pump set with axial suction and common pedestal support. Squirrel cage IP 55 enclosure motor with standard stator and grease lubricated bearings.	1450							
			2900	5	4					
	FMD	Vertical close coupled electrical pump set with lateral suction on the soleplate. Reduced floor space. Squirrel cage IP 55 enclosure motor with standard stator and grease lubricated bearings.	1450							
			2900	5	4					
	FS	Vertically suspended pump, axial suction, lateral discharge close to the hydraulic (d1) level on the risen pipe (d2) or above the soleplate. Intermediate rubber bearing (bronze on request). Thrust bearing housing on the motor support housing with grease lubricated bearings. Semi flexible coupling with a self aligning axis.	1450	7	6	5	4	3		
			2900	7	6	5	4	3		
				upon request						

\* See pumps NMAD - NMD

**Operating limits**

Water and non corrosive or abrasive liquids.

Max temperature :

- 80 °C for sizes 50, 65, 80.
- 105 °C for sizes 100, 125, 152, 202.

Maximum working pressure at discharge : 25 bar

Maximum suction pressure :

- 16 bar for sizes up to 125
- 10 bar for sizes 152 and 202.

For other operating conditions, please refer to us.

**Standard execution**

Soft packing.

Casing in cast iron grade 250 (BS 1452).

Diffusers and impellers in Noryl GFN3 reinforced with 30 % glass fiber for sizes 50-65-80.

Cast iron impellers and diffusers for sizes 100, 125, 152, and 202.

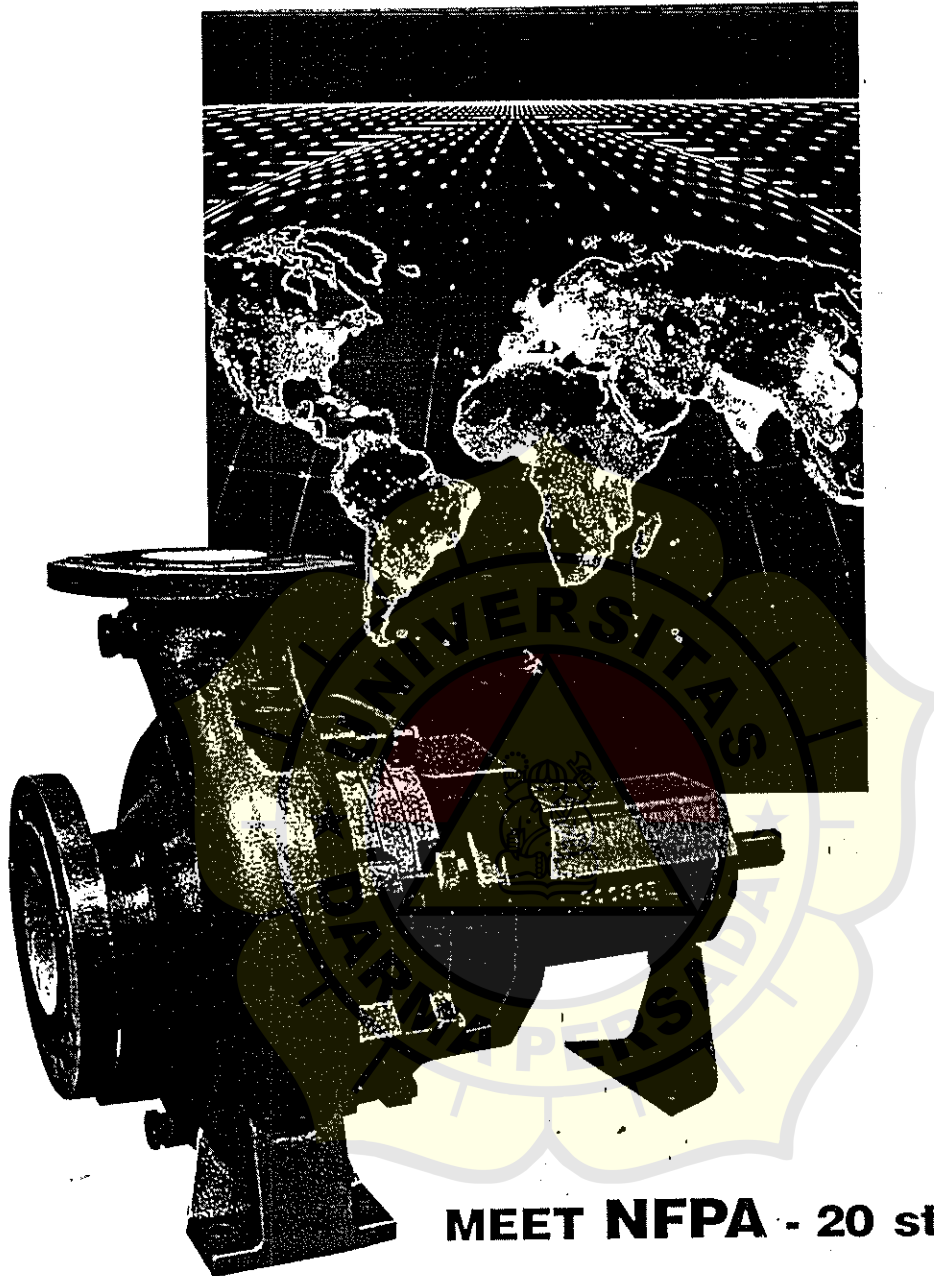
Shaft in carbon steel.

Shaft sleeve in stainless steel grade 420 S 37 (BS 970).

Other construction upon request.

# Standard Water Pumps MEN

DIN 24 255



**MEET NFPA - 20 standard**



**Ingersoll-Dresser Pumps**

# Single Stage Water Pump "MEN"

In the design and manufacture of the new generation of MEN 16 bar pumps, the technical expertise and experience of INGERSOLL-DRESSER PUMPS is apparent.

The following features are revealed in the hydraulic and mechanical design of this range of pumps :

- improved hydraulics
- improved safety
- improved reliability

The objective was to improve upon current standards to achieve better design, performance and manufacturing targets, thus giving customers a better service.

Many options were analysed bringing together Marketing, Engineering and Manufacturing in a concurrent engineering project assisted by Computer Aided Draughting and Design.

Casting development was evaluated using the latest foundry process and techniques, ensuring that high performance and reliability are attained.

Experience gained over the years together with that of seal manufacturers and users has served to help us generate the most advanced concepts and materials to facilitate seal maintenance.

The MEN pump is the result of this project.

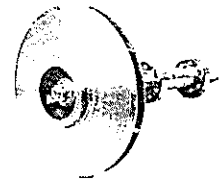
It complies with the latest international standards and specifications used in Europe.

The dimensions and the flanges comply with DIN 24 255 and EN 733.

The modular conception reduces the number of components and guarantees the indispensable availability of a continuous service.

This standardised MEN range consists of 33 sizes and is complemented by the following range :

for greater heads, 2 sizes of MHF pumps are available, and for greater capacities, 19 sizes of ME pumps are available.



## OPERATING LIMITS

Maximum working pressure	discharge	16 bar
	suction	10 bar
Test pressure		21 bar
Maximum liquid temperature	gland packing	105° C
	mechanical seal	120° C

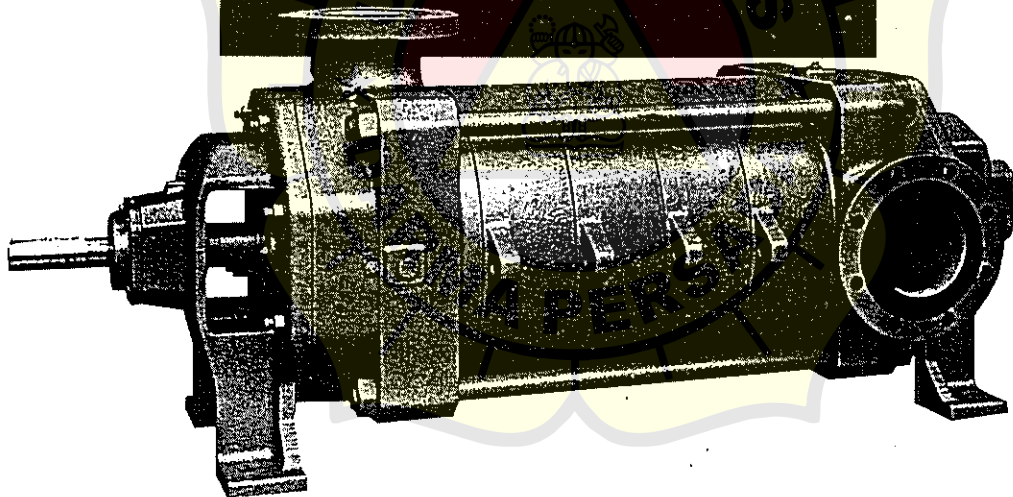
## MATERIALS

DESCRIPTION	STANDARD		OPTIONS	
	Gland packing	Mechanical seal	Gland packing	Mechanical seal
Casing	Cast Iron Grade 250 (BS 1452)			
Casing cover with stuffing box	Cast Iron Grade 250 (BS 1452)			
Wear ring			Stainless Steel Grade 420 S 37 (BS 970)	
Impeller	Cast Iron Grade 250 (BS 1452)		Bronze LG 4 (BS 1400)	
Bearing housing	Cast Iron Grade 250 (BS 1452)			
Shaft	Stainless Steel Grade 420 S 37 (BS 970)		Nickel (16 %) Chromium (5 %) Stainless Steel or Duplex Stainless Steel Grade 22/5	
Shaft sleeve	Stainless Steel Grade 420 S 37 (BS 970)		Nickel (16 %) Chromium (5 %) Stainless Steel or Duplex Stainless Steel Grade 22/5	
Gland packing	Graphite PTFE			
Mechanical seal		Graphite Céramic		Silicon Carbide Silicon Carbide

# NM Multistage Pumps

25/30 bar

**MEET  
NFPA - 20  
standard**



**Ingersoll-Dresser Pumps**

# Multistage water pumps

## NM 25/30 bar

In the design and manufacture of the new generation of NM 25/30 bar pumps, the technical expertise and experience of INGERSOLL-DRESSER PUMPS is apparent.

The following features are incorporated in the hydraulic and mechanical design of this pump range :

- improved hydraulics,
- improved safety,
- improved reliability.

The objective was to improve upon current standards to achieve better design, performance and manufacturing targets, thus giving customers the best service.

Many options were analysed bringing together Marketing, Engineering and Manufacturing in a concurrent engineering project assisted by Computer Aided Draughting and Design.

Casting development was evaluated using the latest foundry processes and techniques, ensuring high performance and reliability.

The NM range complies with the latest international standards and specifications used in Europe.

The modular concept gives maximum interchangeability of components with subsequent low inventory costs.

This range consists of 5 sizes and 10 hydraulics respectively identified by : E for low flow, L for high flow.

The following arrangements are available :

- NM**
- horizontal, 2 bearings,
  - defined by the discharge diameter,
  - adjustable side suction and discharge nozzles.

- FP**
- horizontal, 1-bearing,
  - defined by the suction diameter,
  - axial suction and adjustable side discharge nozzles.

**NMD, NMAD**

- vertically mounted,
- defined by the discharge diameter,
- with semi-elastic coupling and thrust bearing housing (NMD),
- with rigid coupling (NMAD),
- adjustable side suction and discharge nozzles.

OPERATING LIMITS						
Maximum working pressure (bar)	NM	122	152	202	252	352
	suction side	10	10	10	16	16
	discharge side	25	30	35	40	40
	FP	152	202			
	discharge side	25	25			
	NMD/NMAD	122	152	202		
	discharge side	25	30	35		
	Test pressure	1,5 maximum working pressure				
Maximum liquid temperature	gland packing 105 °C mechanical seal 80 °C					

5 sizes					
NM	122	152	202	252	352
FP	152	202			
NMD/NMAD	122	152	202		

MATERIALS		
DESCRIPTION	STANDARD	OPTIONS
Suction casing	Cast iron	
Discharge casing	Cast iron	
Stage casing	Cast iron	
Diffuser	Cast iron	
Wear ring		13 % Chromium stainless steel
Impeller	122 to 252	Cast iron
	352	Bronze
Shaft	NM	13 % Chromium steel
	FP	Steel
Shaft sleeve		13 % Chromium stainless steel
Shaft seal	Gland packing Graphite + PTFE	Mechanical seal Graphite/stainless steel

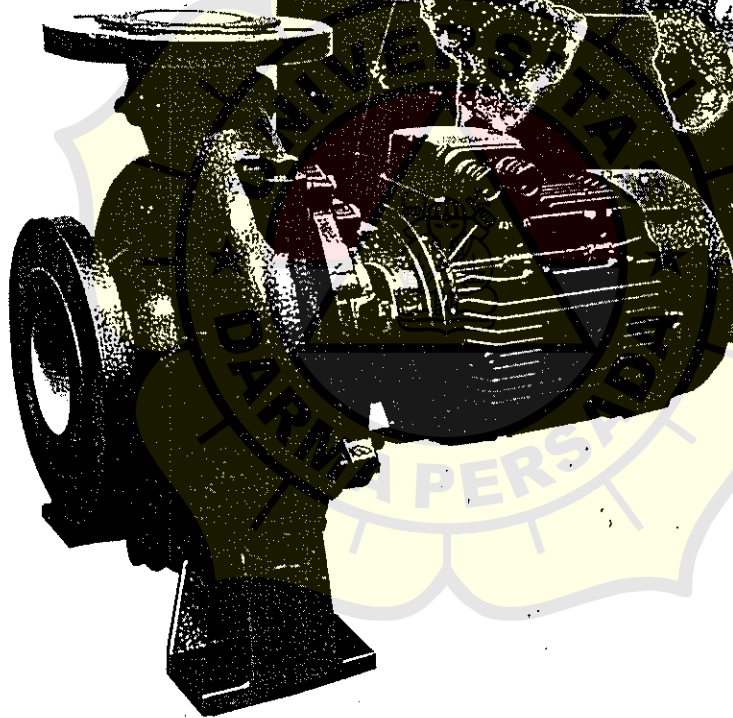
# MENBLOC

Blockpumpen

Close-coupled pumps

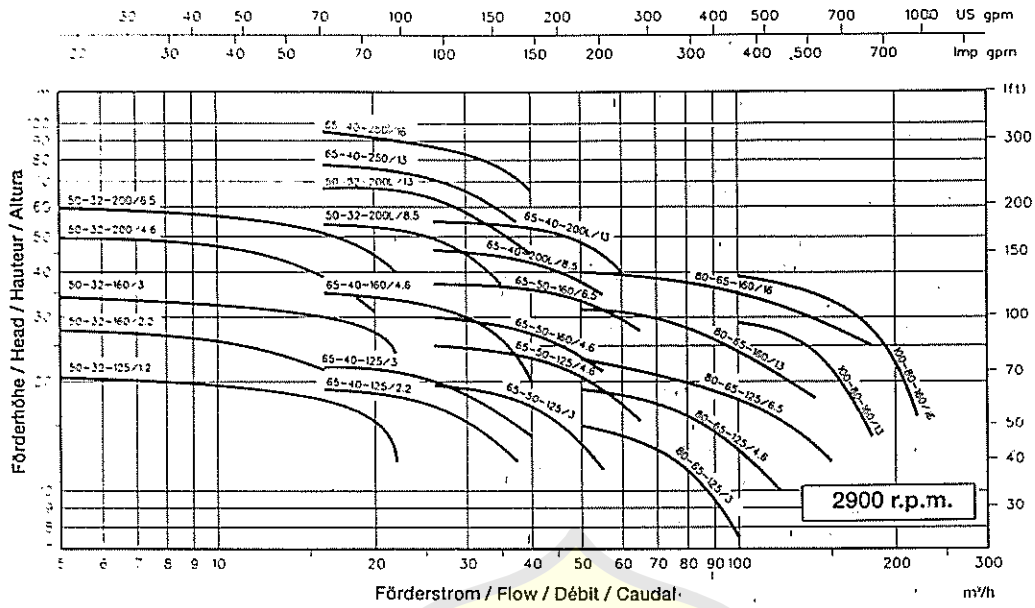
Pompes monobloc

Bombas monobloc

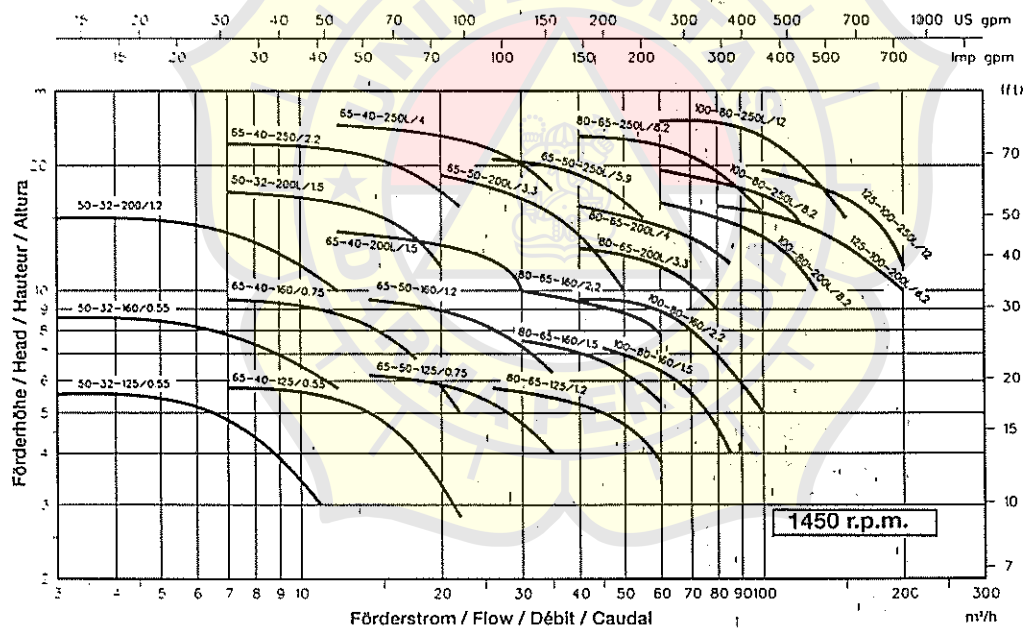


**Ingersoll-Dresser Pumps**





Hyd. DIN 24 255



Hyd. DIN 24 255

### Ingersoll-Dresser Pompes

Ingersoll-Rand Pacific Worthington Pleuger Science  
Pompes Jaumont-Schneider

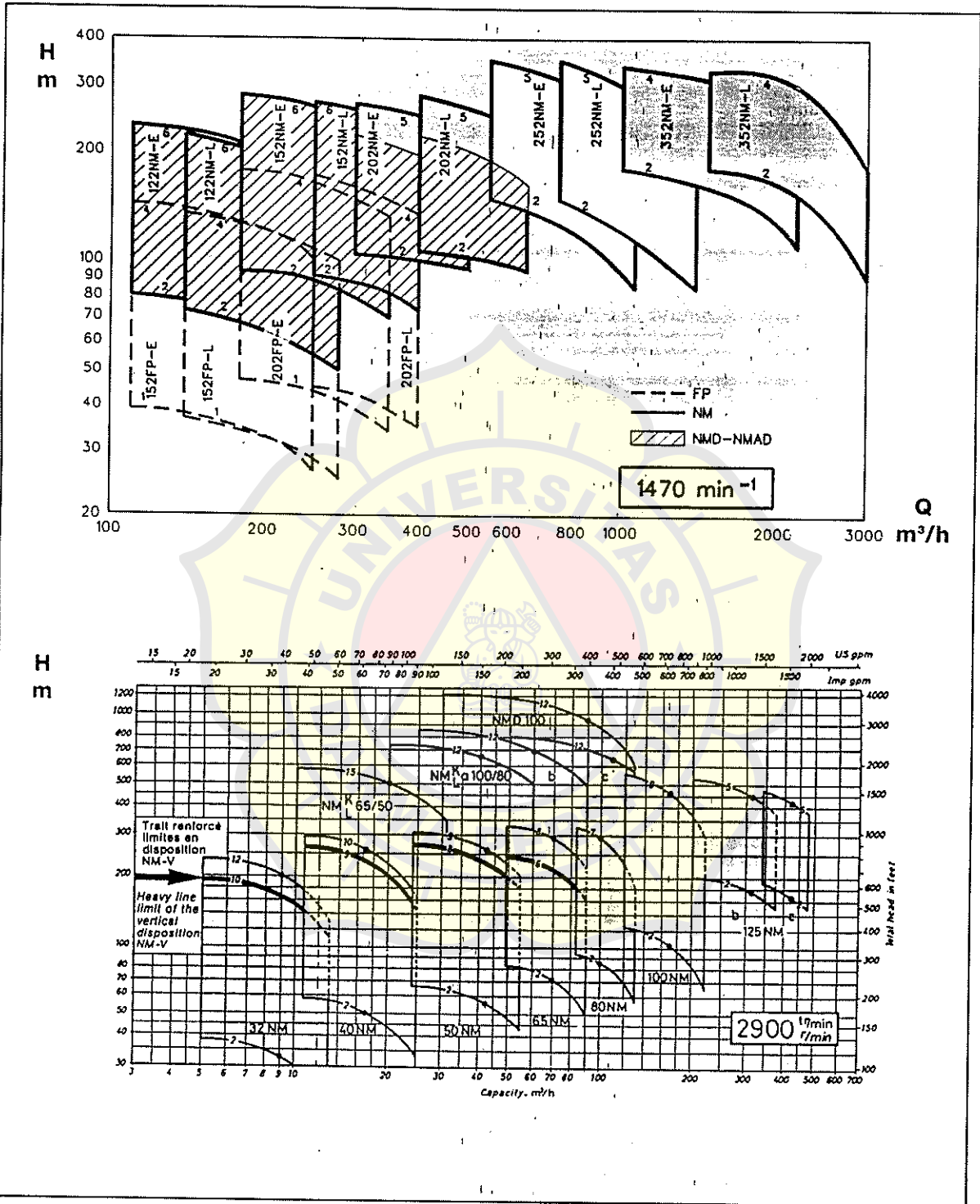
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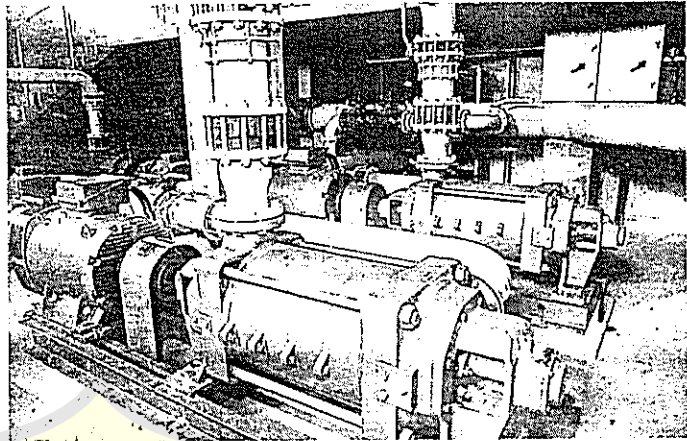
**Ingersoll-Dresser Pumps**

# Coverage charts



# Global Strength and Local Commitment

- Water supply and cold water circulation
- Sprinkling and irrigation
- Boosting
- Fire protection
- Boiler feed
- Drainage



## OUR COMPANY

47 factories in 18 countries with a workforce of over 8 000. That's the worldwide strength of INGERSOLL-DRESSER PUMPS, but it's our local involvement that sets us apart. A network of sales offices, agents and distributors, supported by fast response centres with pump repair and service facilities, combines global resources with specific regional expertise to help you improve performance and reduce operating costs.

## OUR COMMITMENT

Our main concerns are respect for the environment, conservation of natural resources and saving of energy.

Our ability to satisfy individual demands from a proven international knowledge and product base, gives us the edge.

Demands for a safer environment have increased pressure on both users and pump manufacturers.

The NM water pump is designed and manufactured according to modern technologies which will give you reliability in the most severe conditions of service. That's why we maintain a permanent and rigorous control at each stage of design, manufacture and testing.

Human resources and the latest technology together with commitment to Total Quality explain the excellent performance of thousands of pumps operating in various water industry and associated applications.

**Answering specific industry questions and solving unique customer problems so cost-efficiently is only possible through Ingersoll-Dresser's global strength and local commitment.**

**To discover how you can make the most of this best of all possible worlds, talk to your local representative now.**

### Sole Agent :

**PT. KILANDRA JAYATAMA**

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### Ingersoll-Dresser Pompes

Ingersoll-Rand Pacific Worthington Pleuger Science  
Pompes Jeumont-Schnelder

Route d'Angers - 72230 Arnage

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France

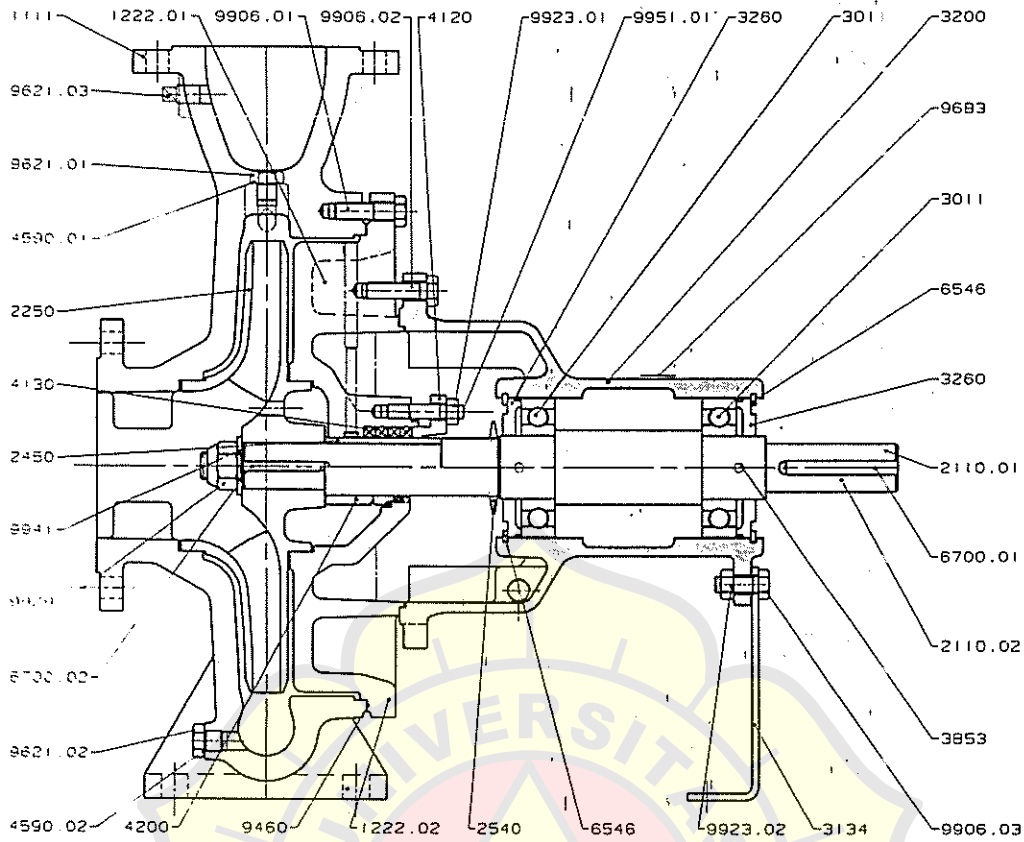
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**Ingersoll-Dresser Pumps**

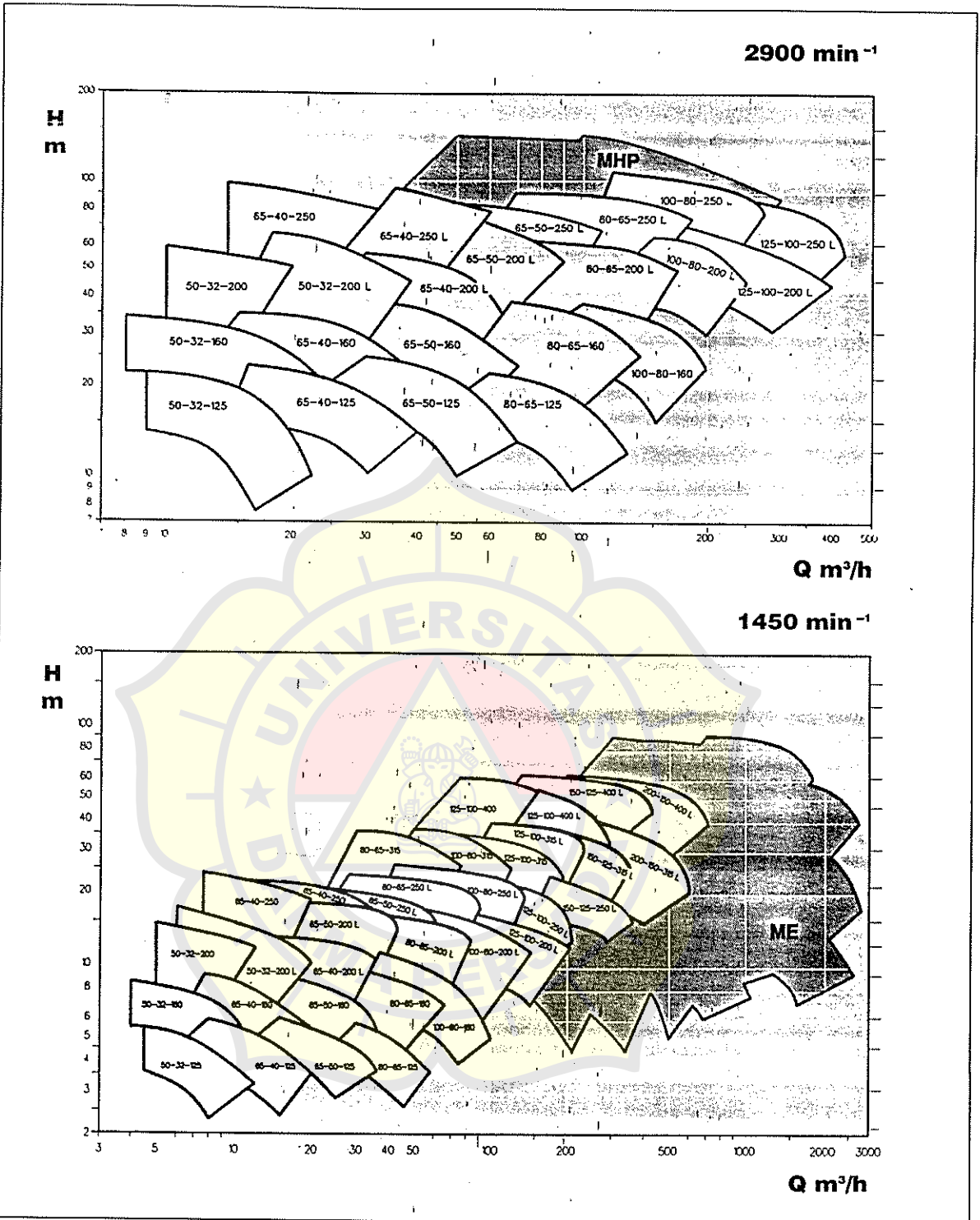
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# “Europump” Specification

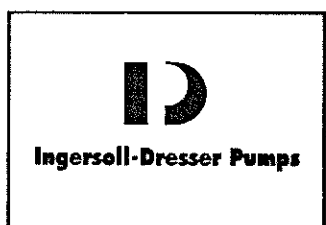


N°	Description
1111	Pump casing
1222.01	Casing cover (gland packing)
1222.02	Casing cover (mechanical seal)
2110.01	Pump shaft (gland packing)
2110.02	Pump shaft (mechanical seal)
2250	Radial flow impeller shrouded
2450	Shaft sleeve
2540	Thrower
3011	Radial ball bearing
3134	Support foot
3200	Bearing housing
3260	Bearing cover
3853	Grease nipple
4120	Stuffing box gland

N°	Description
4130	Gland packing
4200	Mechanical seal
4590	Gasket
6546	Circlip
6700.01	Shaft key for coupling
6700.02	Shaft key for impeller
9460	Gasket (pump casing/casing cover)
9621	Plug
9683	Description plate
9906	Hexagon bolt
9923	Hexagon nut
9929	Self-locking nut
9941	Plain washer
9951	Stud

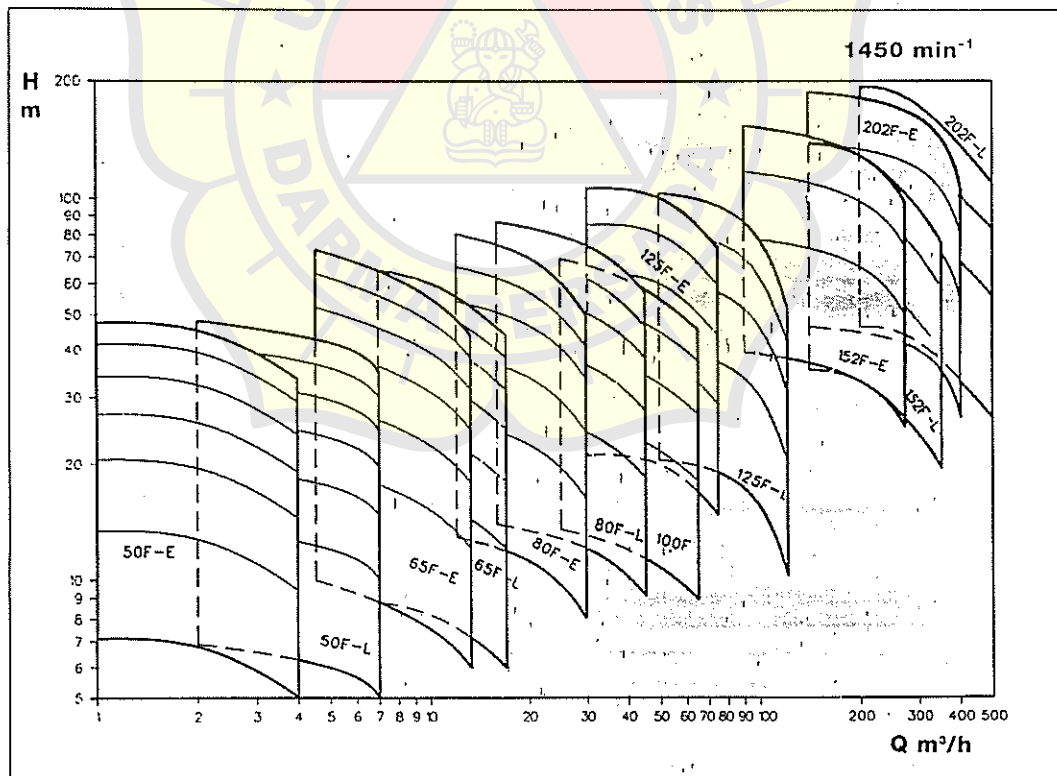
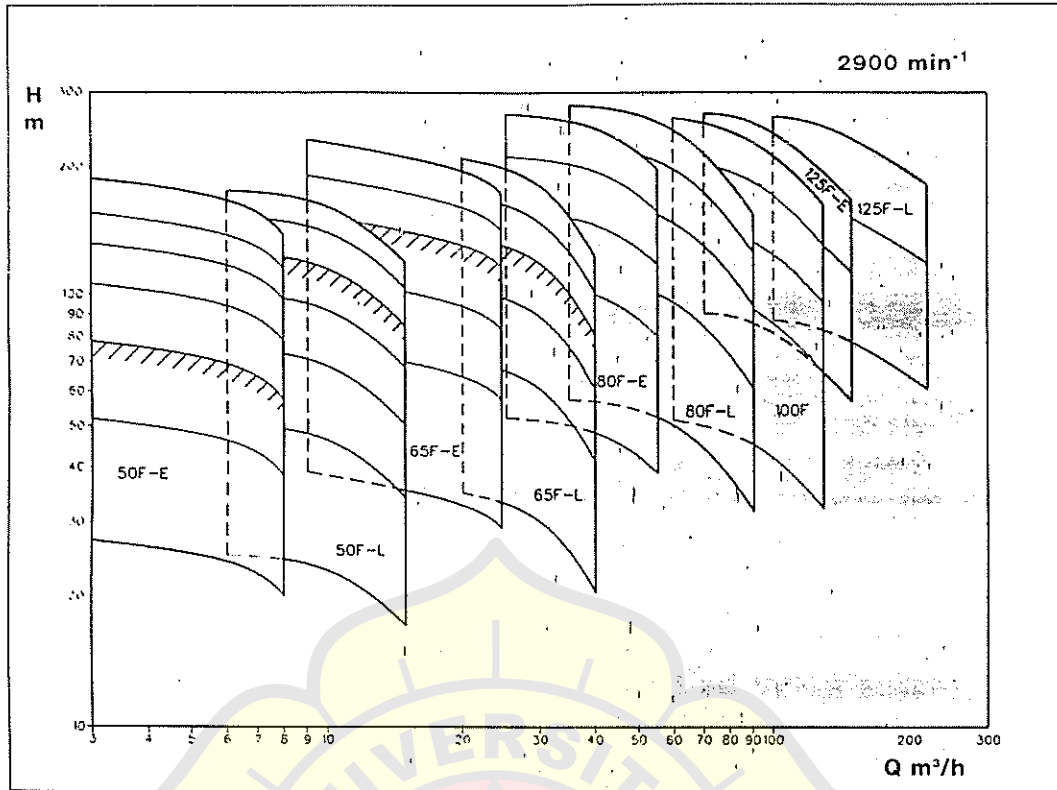


<p><b>Sole Agent :</b></p> <p><b>PT. KILANDRA JAYATAMA</b>          NILAKANDI BUILDING 4th Floor          1-3, ROA MALAKA UTARA STREET          Phone : (021) 6910225, 6912513(Hunting)</p>	<p><b>Ingersoll-Dresser Pompes</b>          Ingersoll-Rand Pacific Worthington Plunger Science          Pompes Jeumont-Schnaider</p> <p>Route d'Angers - 72230 Arnage          B.P. 305 - 72007 Le Mans cédex          France</p> <p>Tél. (33) 43 40 57 57 - Télex 720 079 F - Fax (33) 43 40 57 10</p>
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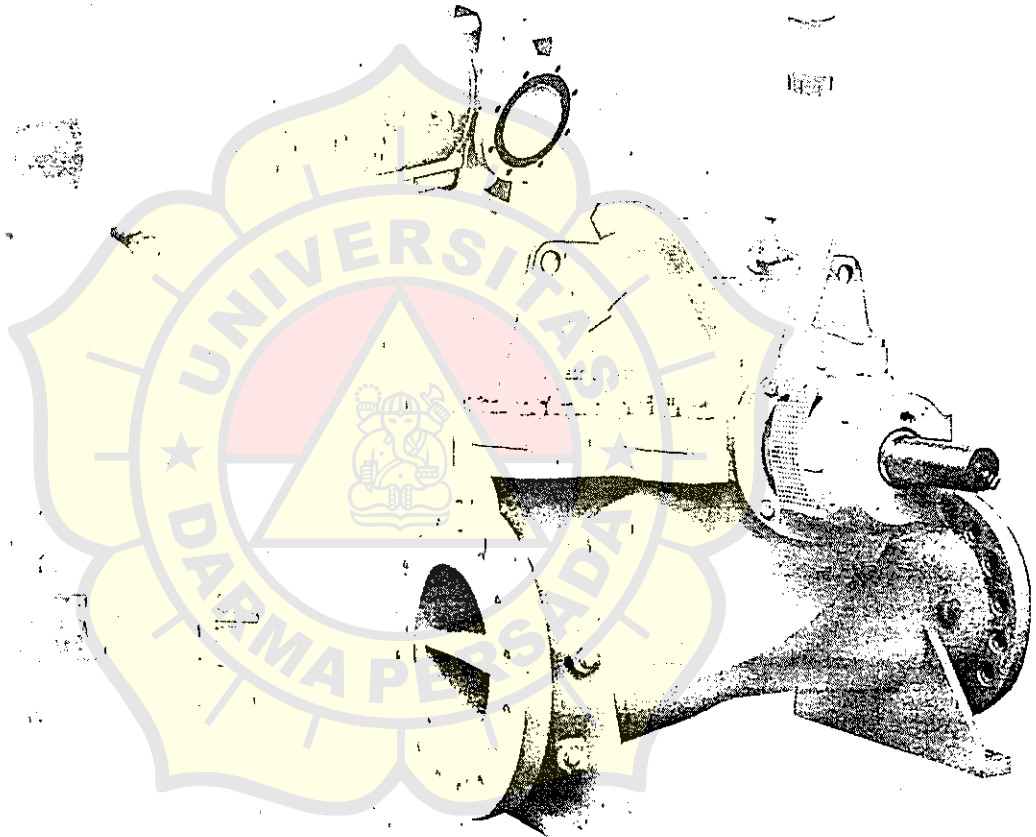
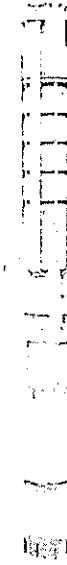
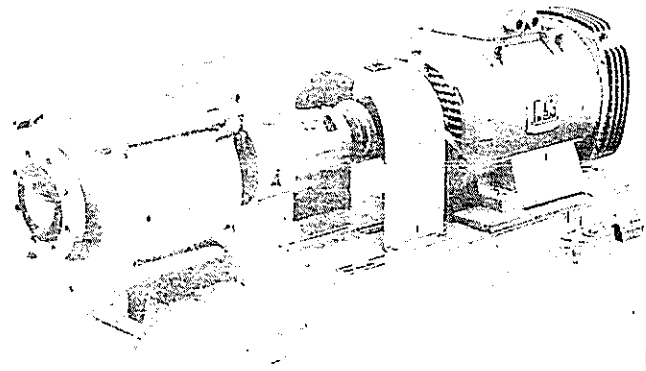


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# Coverage chart - 50 Hz



DCA.11.93.105 AN



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**Ingersoll-Dresser Pompes**

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Pompes Jaumont-Schnolder

Route d'Angers - 72230 Arnage

✉ B.P. 305 - 72007 Le Mans cédex

France

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**Ingersoll-Dresser Pompes**

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Pompe centrifuge monocellulaire à double flux et plan de joint longitudinal.

Le corps de pompe est réalisé en 2 parties assemblées au niveau de l'axe.

Une partie porte les tubulures d'aspiration et de refoulement et les pattes de fixation, l'autre partie, facilement démontable, permet d'accéder au mobile sans débrider les tuyauteries et sans désaligner la machine d'entraînement.

La roue à double entrée se comporte comme deux roues montées dos à dos qui fonctionnent en parallèle et assurent un débit double dans des conditions d'aspiration remarquables (faible NPSH).

La parfaite symétrie axiale de la pompe élimine toute poussée axiale et soulage d'autant les paliers situés de part et d'autre de la pompe.

*Double suction type and horizontally split single-stage centrifugal pumps.*

*The 2 parts of the pump casing are assembled on the axis level.*

*One part is supporting the suction and delivery pipings as well as the mounting feet; the other part, easy to dismount, allows to have access to the mobile without undrbridling the pipes and without risk of disalignment for the driving machine.*

*The double inlet impeller is as two impellers mounted back on back, which operate in parallel and allows a double flow in extremely good suction conditions (low NPSH).*

*The perfect axial symmetry of the pump eliminates any kind of axial thrust and allows to relieve the bearings situated at two opposite sides of the pumps.*

MP Pompe à axe horizontal, tubulures  
MPE d'aspiration et de refoulement en ligne,  
BPS pattes sous corps de pompe.

MP-V Pompe à axe vertical, posée pour fosse  
MPE-V sèche, moteur directement supporté  
BPS-V par la pompe, tubulures d'aspiration et  
de refoulement en ligne.

MP-Y Pompe à axe vertical, posée pour fosse  
MPE-Y sèche, moteur posé au sol sur plancher  
BPS-Y supérieur, commandée par transmission  
à cardan.

MP Horizontal pump, suction and  
MPE delivery pipings in line, feet under  
BPS pump casing.

MP-V Standing vertical pump for dry pit,  
MPE-V motor directly supported by the  
BPS-V pump, suction and delivery pipings  
in line.

MP-Y Standing vertical pump for dry pit,  
MPE-Y motor on earth on upper floor,  
BPS-Y operating with cardan shaft.

Ces pompes sont conçues pour le transport d'eau froide (adduction collective et industrielle, irrigation collective), d'eau chaude (circuit de refroidissement, chauffage) et de liquides divers compatibles avec la nature des matériaux proposés (industries, agro-alimentaire, chimie, papeterie, etc...).

Des exécutions spéciales sont prévues pour s'adapter à toutes conditions d'exploitation particulières (roue antipulsation, refroidissement, revêtement interne, etc...).

*These pumps are designed for the transportation of cold water (collective and industrial water supply, collective irrigation), of warm water (cooling circuit, heating) and of any liquids compatible with the nature of the proposed materials (industry, foodstuff industry, chemical industry, paper mills,...).*

*Special constructions are provided in order to be adapted with any kind of operating conditions (anti-pulsation impeller, cooling device, internal coating,...).*

Eau et liquides divers non chargés, non corrosifs, non abrasifs.

Densité 1, viscosité 1 mm<sup>2</sup>/s.

Température maximale 100° C (MP - MPE)  
70° C (BPS)

Débit minimal sans limitation de durée, 0,4 fois le débit nominal.

Autres conditions: nous consulter.  
Voir fascicule réf. 810-10-26 a.

*Water and any liquids non slurry, non corrosive, non abrasive.*

*Gravity 1, viscosity 1 mm<sup>2</sup>/s.*

*Max. temperature 100° C (MP - MPE)  
70° C (BPS).*

*Min. flow with no time limitation:  
0.4 x nominal flow.*

*Other constructions: consult us.  
See technical document ref. 810-10-26 a.*

Bagues d'usure rapportées dans le corps de pompe en bronze. Etanchéité par garniture à tresse. Arbre en acier entièrement chemisé en bronze. Corps de pompe et roue en fonte. Paliers à roulements lubrifiés à la graisse.

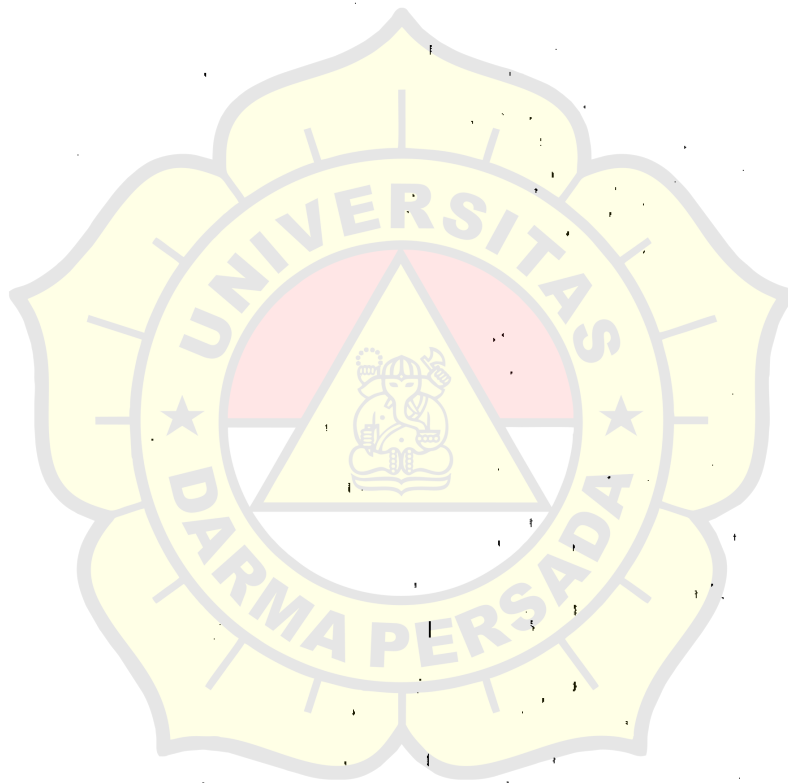
Autres constructions, nous consulter.  
Voir fascicule réf. 810-10-26 a.

*Wear rings fixed on the pump casing in bronze. Tightness by stuffing-box. Complete shaft sleeves in bronze. Pump casing and impeller in cast iron. Oil lubricated bearings.*

*Other constructions, consult us.  
See technical document ref. 810-10-26 a.*



DCA-03-90-110



Pour autres dispositions et renseignements complémentaires, voir fascicule  
For further information, refer to our brochure

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R404A ■ R507

Leistungswerte,  
bezogen auf 25°C Sauggastemperatur,  
mit Flüssigkeitsunterkühlung; 50 Hz

Performance data,  
based on 25°C suction gas temperature;  
with liquid subcooling; 50 Hz

Données de puissance,  
se référant une température de gaz aspiré de  
25°C; avec sous-refroidissement; 50 Hz

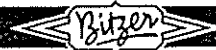
Type	Umgeb.-Temp.	Type	Ambient temp.	Type	Temp. ambiante °C	Kälteleistung Refrigerating capacity Puissance frigorifique (kW)						Leistungsaufnahme Power consumption Puissance absorbée (kW)																
						Verdampfungstemperatur °C			Evaporation temperature °C			Température d'évaporation °C			Verdampfungstemperatur °C			Evaporation temperature °C			Température d'évaporation °C							
						10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	
LH 33/2HL-1.2Y	27	32	32	32	32					3520	2980	2470	2010	1600	1230	900												
	32								1,63	1,44	1,26	1,10	0,95	0,80	0,64													
	43								1,69	1,48	1,29	1,12	0,95	0,79	0,62													
LH 33/2GL-2.2Y	27	32	32	32	32	5760	5140	4510	3900	3310	2760	2260	1800	1390	1020													
	32					2,78	2,46	2,17	1,92	1,69	1,48	1,28	1,09	0,93	0,76													
	43							4140	3560	3040	2540	2060	1630	1250	900													
LH 44/2GL-2.2Y	27	32	32	32	32	6560	5760	4980	4240	3560	2940	2380	1890	1440	1060													
	32					2,56	2,29	2,05	1,84	1,64	1,45	1,27	1,09	0,93	0,76													
	43					6060	5320	4600	3920	3290	2710	2190	1720	1300	935													
LH 44/2FL-2.2Y	27	32	32	32	32					5030	4260	3540	2880	2290	1760	1300												
	32								2,35	2,08	1,83	1,59	1,37	1,15	0,93													
	43							4630	3920	3250	2640	2080	1580	1140														
LH 44/2EL-2.2Y	27	32	32	32	32					5710	4870	4070	3330	2660	2050	1520												
	32								2,50	2,24	2,21	1,92	1,64	1,37	1,10													
	43							5230	4470	3730	3040	2410	1840	1340														
LH 64/2EL-3.2Y	27	32	32	32	32	10550	9360	8000	6750	5620	4610	3710	2920															
	32					3,47	3,19	2,91	2,64	2,38	2,12	1,87	1,65	1,44	1,16													
	43					10060	8690	7430	6260	5210	4260	3410	2660	2080	1580													
LH 53/2DL-2.2Y	27	32	32	32	32					6780	5770	4820	3940	3140	2430	1790												
	32								3,39	2,97	2,59	2,25	1,93	1,61	1,30													
	43							6220	5360	4420	3600	2850	2180	1580	1250													
LH 64/2DL-3.2Y	27	32	32	32	32	12230	10620	9110	7720	6450	5310	4290	3380															
	32					4,22	3,85	3,49	3,15	2,82	2,51	2,21	1,94	1,68	1,44													
	43					11310	9830	8440	7150	5970	4900	3940	3080	2390	1840													
LH 64/2CL-3.2Y	27	32	32	32	32					9050	7610	6300	5100	4040	3085	2270												
	32								3,95	3,50	3,10	2,70	2,35	2,00	1,60													
	43							8370	7030	5800	4675	3670	2780	2000														
LH 84/2CL-4.2Y	27	32	32	32	32	15350	13260	11350	9590	7990	6560	5300	4160															
	32					5,00	4,60	4,20	3,80	3,40	3,05	2,70	2,35	2,00	1,60													
	43					14210	12310	10530	8890	7410	6060	4870	3795	2950	2240													
LH 64/2U-3.2Y	27	32	32	32	32					10400	8770	7280	5920	4720	3650	2730												
	32								4,30	3,83	3,40	3,01	2,63	2,28	1,95													
	43							9610	8110	6720	5460	4320	3320	2450														
LH 84/2U-5.2Y	27	32	32	32	32	17620	15290	13110	11100	9270	7630	6170	4880															
	32					5,22	4,77	4,37	4,01	3,66	3,32	2,97	2,62	2,28	1,95													
	43					16320	14190	12170	10310	8600	7070	5700	4480	3500	2680													

8 Vorläufige Werte

Tentative data

Valeurs provisoires

**R404A ■ R507**



Leistungswerte,  
bezogen auf 25°C Sauggasttemperatur;  
mit Flüssigkeitsunterkühlung, 50 Hz

Performance data,  
based on 25°C suction gas temperature;  
with liquid subcooling, 50 Hz

Données de puissance,  
se référant une température de gaz aspiré de  
25°C; avec sous-refroidissement; 50 Hz

Typ	Umgeb.- Temp.	Type	Ambient temp.	Type	Temp. ambiante °C	Kälteleistung Refrigerating capacity Puissance frigorifique				Leistungsaufnahme Power consumption Puissance absorbée						
						Verdampfungstemperatur °C				Evaporation temperature °C			Température d'évaporation °C			
						10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
LH 64/2Q-4.2Y	27	O							11900	10120	8460	6950	5550	4330	3250	
	32	P							5.34	4.74	4.19	3.68	3.21	2.77	2.35	
	43	P							10940	9320	7780	6370	5060	3930	2920	
LH 84/2Q-6.2Y	27	O							20050	17530	15140	12900	10840	8970	7250	5800
	32	P							8.55	5.95	5.43	4.94	4.49	4.05	3.61	3.17
	43	P							18180	16200	14010	11940	10030	8280	6710	5320
LH 84/2N-5.2Y	27	O							15270	12950	10820	8860	7100	5540	4180	
	32	P							6.60	5.87	5.19	4.56	3.97	3.40	2.85	
	43	P							14050	11950	9970	8160	6520	5060	3780	
LH 104/2N-7.2Y	27	O							25200	22100	19080	16270	13680	11320	9210	7330
	32	P							8.27	7.57	6.90	6.26	5.65	5.07	4.52	3.98
	43	P							23200	20350	17620	15050	12660	10470	8500	6750
LH 104/4Z-8.2Y	27	O							25150	22200	19090	16200	13550	11140	8990	7090
	32	P							7.97	7.30	6.64	6.01	5.40	4.81	4.24	3.67
	43	P							23150	20500	17630	14970	12500	10250	8240	6440
LH 84/4V-6.2Y	27	O							17010	14510	12140	9960	7980	6220	4670	
	32	P							7.69	6.77	5.94	5.18	4.47	3.81	3.18	
	43	P							15630	13340	11160	9140	7290	5640	4180	
LH 114/4V-10.2Y	27	O							29500	25750	22200	18920	15880	13120	10650	8450
	32	P							9.31	8.54	7.79	7.07	6.38	5.71	5.05	4.40
	43	P							27200	23800	20550	17510	14690	12120	9800	7740
LH 104/4T-8.2Y	27	O							21250	18100	15160	12460	10020	7850	5950	
	32	P							9.37	8.28	7.31	6.41	5.57	4.79	4.05	
	43	P							19540	16670	13960	11450	9170	7140	5340	
LH 114/4T-12.2Y	27	O							33450	29550	25750	22150	18740	15610	12770	10240
	32	P							11.99	10.94	9.92	8.95	8.03	7.17	6.33	5.51
	43	P							27200	23750	20450	17300	14400	11780	9380	7400
LH 114/4P-10.2Y	27	O							25100	21400	17850	14610	11680	9080	6810	
	32	P							11.28	9.99	8.65	7.49	6.41	5.39	4.41	
	43	P							23150	19720	16460	13450	10710	8280	6140	
LH 135/4P-15.2Y	27	O							46450	40150	34300	28950	24100	19790	15950	12580
	32	P							13.01	11.96	10.94	9.95	9.01	8.11	7.21	6.30
	43	P							43150	37300	31900	26950	22400	18370	14760	11580

○ Leistungsaufnahme des Verdichters,  
Werte für Ventilator-Ventilatoren siehe  
"Technische Daten" (siehe Seite 16)

○ Power consumption of compressor, values  
for condenser fans see "Technical data"  
(see page 16)

○ Puissance absorbée du compresseur; pour  
les valeurs des condenseur-ventilateurs  
veuillez vous référer aux "Caractéristiques  
techniques" (voir page 16)

Vorläufige Werte

Tentative data

Valeurs provisoires



R404A ■ R507

Leistungswerte,  
bezogen auf 25°C Sauggasttemperatur,  
mit Flüssigkeitsunterkühlung; 50 Hz

Performance data,  
based on 25°C suction gas temperature;  
with liquid subcooling; 50 Hz

Données de puissance,  
se référant une température de gaz aspiré de  
25°C; avec sous-refroidissement; 50 Hz

Typ	Umgeb.-Temp.	Type	Type	Type	Kälteleistung (Watt) / Leistungsaufnahme (Watt) / Puissance absorbée (Watt)											
					Verdampfungstemperatur °C				Evaporation temperature °C				Température d'évaporation °C			
					10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	
LH 124/4N-12.2Y	27	O	P						30000	25550	21400	17540	14080	11010	8320	
	32	O	P						12,98	11,50	10,14	8,86	7,65	6,48	5,36	
	43	O	P						27600	23550	19700	16150	12930	10060	7530	
LH 135/4N-20.2Y	27	O	P		51700	45050	38800	33050	27700	22900	18590	14790				
	32	O	P		15,54	14,33	13,11	11,92	10,79	9,70	8,64	7,57				
	43	O	P		47600	41600	35900	30600	25700	21200	17180	13610				
LH 135/4J-13.2Y	27	O	P					42450	36400	30750	25600	20950	16930	13170	9980	
	32	O	P					16,02	14,35	12,78	11,30	9,92	8,60	7,33	6,09	
	43	O	P						33700	28500	23700	19370	15490	12040	9030	
LH 135/4J-22.2Y	27	O	P		55200	48300	41700	35600	29900	24800	20150	16090				
	32	O	P		18,41	16,76	15,20	13,69	12,24	10,85	9,50	8,18				
	43	O	P		50900	44700	38650	33000	27750	22950	18630	14810				
LH 135/4H-15.2Y	27	O	P					40800	34500	29000	23900	19260	15170	11560		
	32	O	P					17,01	15,12	13,36	11,70	10,14	8,63	7,16		
	43	O	P					37700	32100	26850	22100	17750	13900	10500		
LH 135/4H-25.2Y	27	O	P		60600	53600	46550	39900	33750	28100	23000	18430				
	32	O	P		22,20	20,08	18,11	16,25	14,48	12,80	11,20	9,66				
	43	O	P			49350	43050	37000	31300	26000	21250	16970				
LH 135/4G-20.2Y	27	O	P					45100	38600	32500	26850	21800	17240	13230		
	32	O	P					20,25	17,97	15,85	13,86	12,00	10,21	8,49		
	43	O	P					41600	35650	30000	24800	20100	15820	12040		
LH 135/6J-22.2Y	27	O	P					48800	41900	35400	29300	23750	18770	14340		
	32	O	P					22,85	20,16	17,65	15,31	13,13	11,07	9,11		
	43	O	P					44900	38600	32600	27000	21800	17150	12980		
LH 135/6H-25.2Y	27	O	P					53700	46550	39600	33050	27000	21450	16520		
	32	O	P					27,28	24,00	20,95	18,13	15,52	13,07	10,74		
	43	O	P						42750	36400	30400	24800	19630	15000		

Leistungsaufnahme des Verdichters  
siehe für Ventilatoren siehe  
"Technische Daten" (siehe Seite 16)

Power consumption of compressor; values  
for condensers fans see "Technical data"  
(see page 16)

Puissance absorbée du compresseur; pour  
les valeurs des condenseur-ventilateurs  
veuillez vous référer aux "Caractéristique  
techniques" (voir page 16)

Leistungswerte

Tentative data

Valeurs provisoires





**R22**



Leistungswerte,  
basieren auf 25°C Sauggastemperatur,  
mit Flüssigkeitsunterkühlung; 50 Hz

Performance data,  
based on 25°C suction gas temperature;  
with liquid subcooling; 50 Hz

Données de puissance,  
se référant une température de gaz aspiré de  
25°C; avec sous-refroidissement; 50 Hz

Typ	Umgeb.-Temp.	Type	Ambient temp.	Type	Temp. ambiante °C	Kälteleistung																
						Refrigerating capacity																
						Puissance frigorifique																
						Verdampfungstemperatur °C				Evaporation temperature °C				Température d'évaporation °C								
						10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	P <sub>0</sub> (kW)					
LH 33/2HL-1.2	27	O	P						3920	3270	2700	2230	1820	1420	1070	770						
	32	O	P						1,54	1,39	1,24	1,08	0,97	0,78	0,63							
	43	O	P						3700	3080	2530	2000	1610	1230	905	665						
LH 33/2GL-2.2	27	O	P						4430	3720	3070	2510	2050	1530	1130	830						
	32	O	P						1,80	1,61	1,44	1,26	1,11	0,88	0,71							
	43	O	P						4180	3500	2880	2350	1890	1410	1030	760						
LH 44/2GL-2.2	27	O	P						7630	6570	5610	4700	3940	3230	2630	2100						
	32	O	P						2,21	2,01	1,83	1,67	1,52	1,38								
	43	O	P						7240	6230	5300	4460	3710	3040	2490	2000						
LH 44/2FL-2.2	27	O	P						5620	4710	3890	3220	2660	2170	1760	1410						
	32	O	P						2,21	2,00	1,80	1,65	1,50	1,37								
	43	O	P						5320	4440	3660	3040	2510	2030	1630	1300						
LH 44/2EL-2.2	27	O	P						6600	5570	4620	3950	3270	2690	2200	1790						
	32	O	P						2,83	2,53	2,26	2,08	1,90	1,74								
	43	O	P						6210	5230	4330	3660	3030	2490	2020	1600						
LH 64/2EL-3.2	27	O	P						12490	10690	9060	7590	6290	5150	4340	3440	2660					
	32	O	P						2,97	2,76	2,55	2,36	2,19	2,02	1,87	1,71	1,55					
	43	O	P						11850	10120	8570	7170	5930	4840	4080	3220	2490					
LH 53/2DL-2.2	27	O	P						7810	6580	5460	4590	3840	3160	2560	2040						
	32	O	P						3,37	3,04	2,73	2,47	2,22	2,00	1,83							
	43	O	P						7350	6180	5110	4300	3590	2930	2340	1830						
LH 64/2DL-3.2	27	O	P						14230	12210	10370	8720	7240	5940	5020	3990	3100					
	32	O	P						3,55	3,30	3,08	2,87	2,66	2,45	2,24	2,02	1,80					
	43	O	P						13470	11550	9810	8230	6830	5580	4710	3730	2890					
LH 64/2CL-3.2	27	O	P						10270	8560	7050	5940	4940	4040	3240	2540						
	32	O	P						3,90	3,55	3,25	2,97	2,70	2,43	2,15	1,86						
	43	O	P						9680	8060	6610	5500	4500	3600	2800	2100						
LH84/2CL-4.2	27	O	P						17730	15180	12870	10800	8960	7330	5910	4675	3610					
	32	O	P						4,25	3,95	3,70	3,45	3,20	2,95	2,70	2,45	2,20					
	43	O	P						16860	14370	12180	10200	8440	6890	5540	4370	3365					

VARICOOL System  
modifizierte Saugventilposition „SL(B)“  
siehe Seite 14

VARICOOL system  
Position of suction service valve changed  
„SL(B)“ see page 14

Système VARICOOL  
Position vanne aspiration modifiée „SL(B)“  
voir page 14

Leistungsaufnahme des Verdichters,  
siehe für Ventilator-Ventilatoren siehe  
technische Daten (siehe Seite 16)

Power consumption of compressor; values  
for condenser fans see "Technical data"  
(see page 16)

Puissance absorbée du compresseur; pour  
les valeurs des condenseur-ventilateurs  
veuillez vous référer aux "Caractéristiques  
techniques" (voir page 16)

Max. Sauggasüberhitzung ΔT<sub>1</sub> = 20K

Suction superheat max 20 K

Surchauffe à l'aspiration max. 20 K

Tentative Werte

Tentative data

Valeurs provisoires



R22

Leistungswerte,  
bezogen auf 25°C Sauggasttemperatur;  
mit Flüssigkeitsunterkühlung; 50 Hz

Performance data,  
based on 25°C suction gas temperature;  
with liquid subcooling; 50 Hz

Données de puissance,  
se référant une température de gaz aspiré de  
25°C; avec sous-refroidissement; 50 Hz

Type	Umgeb.- Temp. Type Ambient temp. Type Temp. ambiante °C	Refrigerating capacity Puissance frigorifique						Power consumption Puissance absorbée											
		Verdampfungstemperatur °C						Evaporation temperature °C						Température d'évaporation °C					
		10	5	0	-5	-10	-15	-20	-25	-30	-35	-40							
LH 64/2U-3.2	27	Q				11650	9720	7980	6520	5200	4070	3110	2310						
	32	P				4,25	3,84	3,44	3,08	2,74	2,42	2,11	1,79						
	43	O				10970	9130	7470	6090	4860	3760	2890	2140						
LH 84/2U-5.2	27	Q	20100	17250	14650	12300	10190	8310	6760	5370	4170								
	32	P	4,93	4,50	4,16	3,87	3,60	3,33	3,06	2,79	2,50								
	43	O	19030	16340	13870	11620	9610	7820	6330	5010	3890								
LH 64/2Q-4.2	27	Q				13330	11170	9210	7550	6050	4750	3650	2720						
	32	P				5,26	4,71	4,20	3,74	3,31	2,88	2,52	2,14						
	43	O				12530	10470	8600	7060	5650	4370	3300	2520						
LH 84/2Q-6.2	27	Q	22950	19810	16900	14240	11840	9680	7890	6280	4900								
	32	P	6,32	5,69	5,18	4,76	4,39	4,04	3,69	3,34	2,99								
	43	O	21700	18730	15970	13430	11140	9090	7380	5860	4560								
LH 84/2N-5.2	27	Q				17250	14510	12030	10260	8250	6500	4990	3720						
	32	P				6,56	5,87	5,26	4,72	4,20	3,69	3,19	2,70						
	43	O				16280	13680	11330	9650	7750	6100	4680	3490						
LH 104/2N-7.2	27	Q	29000	25050	21400	18110	15140	12480	10140	8080	6310								
	32	P	8,11	7,45	6,82	6,22	5,63	5,04	4,47	3,91	3,38								
	43	O	27500	23700	20300	17140	14310	11790	9560	7610	5930								
LH 104/4Z-8.2	27	Q	29000	24950	21200	17820	14760	12050	9650	7570	5770								
	32	P	7,66	6,86	6,25	5,75	5,29	4,84	4,37	3,89	3,38								
	43	O	27450	23600	20050	16820	13900	11300	9010	7020	5300								
LH 84/4V-6.2	27	Q				19160	16050	13210	10670	8500	6560	4880	3430						
	32	P				7,57	6,74	6,00	5,30	4,65	3,99	3,34	2,71						
	43	O				18020	15060	12360	9940	7900	6060	4450	3070						
LH 114/4V-10.2	27	Q	33900	29200	24850	20900	17320	14130	11330	8890	6700								
	32	P	8,99	8,03	7,30	6,71	6,16	5,62	5,07	4,50	3,92								
	43	O	32150	27650	23500	19710	16300	13260	10570	8240	6220								
LH 104/4T-8.2	27	Q				23700	19890	16390	13250	10550	8150	6040	4230						
	32	P				8,73	7,85	7,07	6,31	5,51	4,76	3,99	3,20						
	43	O				22300	18660	15330	12340	9800	7500	5490	3740						
LH 114/4T-12.2	27	Q	38900	33700	28950	24500	20450	16800	13540	10660	8160								
	32	P	11,92	10,45	9,31	8,41	7,63	6,92	6,20	5,45	4,66								
	43	O	36750	31850	27300	23100	19230	15750	12640	9900	7510								
LH 114/4P-10.2	27	Q				27800	23350	19310	15700	12490	9650	7170	5040						
	32	P				10,87	9,52	8,28	7,13	6,13	5,26	4,49	3,81						
	43	O				26250	22050	18200	14750	11660	8930	6540	4490						

12. Vorläufige Werte

Tentative data

Valeurs provisoires



R22



Leistungswerte, bezogen auf 25°C Sauggastemperatur, mit Flüssigkeitsunterkühlung; 50 Hz

Performance data, based on 25°C suction gas temperature, with liquid subcooling; 50 Hz

Données de puissance, se référant une température de gaz aspiré de 25°C; avec sous-refroidissement; 50 Hz

Typ	Umgeb.-Temp.	Type	Ambient temp.	Type	Temp. ambiante °C	Kälteleistung Refrigerating capacity Puissance frigorifique						Leistungsaufnahme Power consumption Puissance absorbée											
						Verdampfungstemperatur °C						Evaporation temperature °C						Température d'évaporation °C					
						10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	10	5	0	-5	-10	-15	-20
LH 135/4P-15.2	27	O	P	P	↓	50800	43500	36900	30950	25650	21000	16980	13310	10250	12.09	11.19	10.36	9.52	8.67	7.79	6.89	5.99	5.11
						48350	41400	35050	29350	24300	19790	15860	12440	9510	13.29	12.19	11.15	10.14	9.13	8.12	7.10	6.10	5.13
						42800	36600	30950	25850	21300	17250	13700	10620	7990	15.43	14.10	12.76	11.44	10.14	8.86	7.60	6.38	5.21
LH 124/4N-12.2	27	O	P	P	↓	31050	28700	23900	19530	15510	12000	8940	6290	12.85	11.35	9.95	8.62	7.46	6.40	5.44	4.60		
						32200	27100	22500	18370	14520	11150	8190	5630	13.58	11.93	10.40	8.94	7.69	6.55	5.52	4.60		
						23900	19670	15940	12470	9400	6700	4360	13.24	11.42	9.71	8.21	6.88	5.69	4.60				
LH 135/4N-20.2	27	O	P	P	↓	59900	50800	43100	36300	30600	25700	20150	16200	12600	15.22	14.04	12.91	11.79	10.68	9.57	8.47	7.39	6.35
						55900	48200	41100	34700	28950	23800	19290	15340	11930	16.45	15.08	13.77	12.49	11.23	9.99	8.77	7.60	6.49
						42750	36350	30550	25350	20750	16700	13180	10160	17.37	15.68	14.06	12.49	10.96	9.48	8.06	6.73		
LH 135/4J-13.2	27	O	P	P	↓	40400	33750	27800	22500	17790	13720	10200	7210	13.46	12.02	10.62	9.26	8.29	7.22	6.19	5.16		
						39300	31950	26250	21200	16590	12670	9290	6410	14.32	12.80	11.28	9.80	8.61	7.41	6.24	5.12		
						33950	28100	22950	18360	14100	10540	7480	4900	16.19	14.33	12.65	10.96	9.34	7.85	6.43	5.03		
LH 135/4J-22.2	27	O	P	P	↓	64600	55900	47800	40450	33800	27850	22550	17880	13810	16.90	15.37	14.03	12.73	11.46	10.21	8.97	7.74	6.51
						61400	53100	45150	38400	32000	26300	21200	16750	12850	18.06	16.36	14.87	13.48	12.13	10.80	9.47	8.14	6.80
						47100	40250	33950	28200	23000	18390	14330	10790	19.35	17.12	15.26	13.59	12.02	10.49	8.97	7.44		
LH 135/4H-15.2	27	O	P	P	↓	45550	38200	31550	25650	20300	15660	11670	8250	16.11	14.32	12.58	10.92	9.71	8.41	7.18	5.97		
						43200	36150	29800	24100	18900	14470	10620	7330	17.09	15.20	13.34	11.54	10.06	8.62	7.24	5.92		
						31800	26000	20850	16070	12040	8570	5610	16.88	14.87	12.86	10.93	9.15	7.47	5.82				
LH 135/4H-25.2	27	O	P	P	↓	72000	62600	53800	45700	38300	31600	25650	20400	15800	20.55	18.55	16.81	15.19	13.62	12.08	10.57	9.08	7.60
						68400	59500	51100	43350	36250	29850	24150	19100	14700	22.27	19.82	17.83	16.05	14.38	12.75	11.14	9.55	7.95
						45200	38250	31900	26100	20900	16340	12330	20.65	18.18	16.05	14.12	12.27	10.46	8.66				
LH 135/4G-20.2	27	O	P	P	↓	50800	42750	35500	28950	22950	17810	13320	9450	19.56	17.24	15.05	13.00	11.61	10.00	8.50	7.10		
						48150	40500	33550	27300	21450	16470	12140	8410	20.71	18.26	15.96	13.77	12.12	10.34	8.68	7.10		
						35650	29400	23700	18270	13760	9930	6460	20.40	18.05	15.87	13.48	11.26	9.11	7.10				
LH 135/6J-22.2	27	O	P	P	↓	55700	47050	39100	31900	25300	19620	14660	10380	22.20	19.57	17.04	14.64	12.80	11.00	9.32	7.71		
						52800	44500	36900	30000	23600	18120	13350	9240	23.43	20.62	17.99	15.44	13.25	11.27	9.41	7.65		
						32150	25900	20100	15120	10800	7100	19.75	17.03	14.46	11.99	9.71	7.52						
LH 135/6H-25.2	27	O	P	P	↓	62100	52700	44000	36050	28650	22250	16660	11820	26.81	23.48	20.36	17.40	15.04	12.85	10.83	8.94		
						58600	49800	41450	33650	26700	20550	15160	10520	28.20	24.61	21.41	18.31	15.56	13.16	10.54	8.87		
						29200	22700	17170	12320	810	20.04	17.05	14.04	11.61	8.72								

ER VARICOOL System  
geänderte Saugventilposition „SL(B)“  
siehe Seite 14  
CIC System

VARICOOL system  
Position of suction service valve changed  
„SL(B)“ see page 14  
CIC system

Système VARICOOL  
Position vanne aspiration modifiée „SL(B)“  
voir page 14  
Système CIC

Leistungsaufnahme des Verdichters  
Power consumption of compressor  
see page 16

Power consumption of compressor; values  
for condenser fans see "Technical data"  
(see page 16)

Puissance absorbée du compresseur, pour  
les valeurs des condenseur-ventilateurs  
veuillez vous référer aux "Caractéristique  
techniques" (voir page 16)

Max. Saugtemperatur A1 = 20K

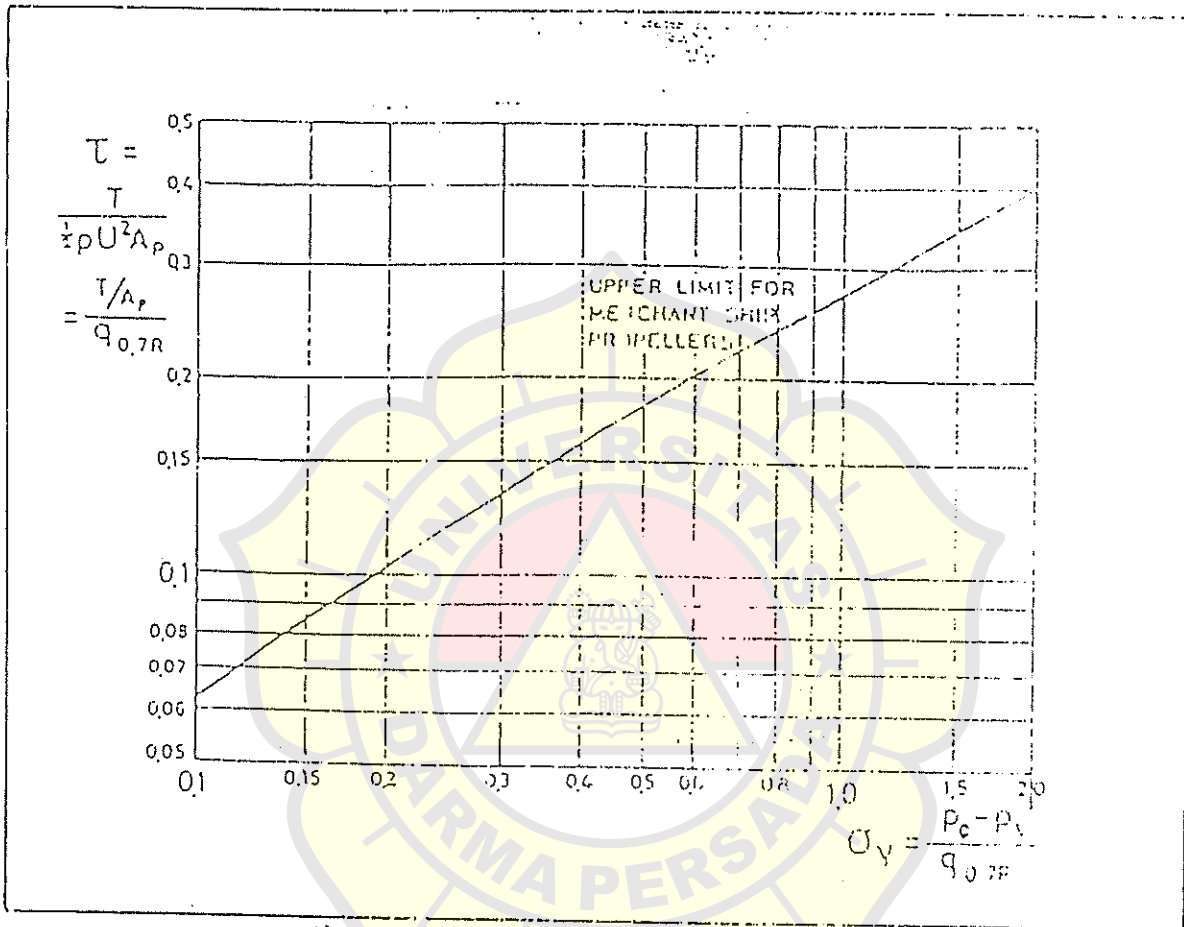
Suction superheat max. 20 K

Surchauffe à l'aspiration max. 20 K

Tentative data

Valeurs provisoires

DIAGRAM " BUREIL "



(B) Water lines (friction factors by lang's experimental formula)

Coarse-grained galvanized steel pipe	0.019
Old cast iron pipe	0.023 - 0.030
Fouled old brass pipe	0.023

$$h = f \cdot \frac{l}{d} \cdot \frac{v^2}{2g} \dots \dots \dots (2.7)$$

where

- h : Frictional loss (m)
- f : Friction factor,  $f = \alpha + 16 \sqrt{\frac{\alpha \cdot g}{v \cdot d}}$
- d : Internal diameter of pipe (m)
- l : Length of equivalent straight pipe (m)
- v : Average velocity in pipe (m/s)
- $\alpha$  : Coefficient
- $\sigma$  : Kinematic viscosity ( $m^2/s$ )

$\sigma$ for fresh water:	
0°C	$0.01775 \times 10^{-4}$
10°C	$0.01320 \times 10^{-4}$
20°C	$0.01010 \times 10^{-4}$
30°C	$0.00805 \times 10^{-4}$
40°C	$0.00695 \times 10^{-4}$
60°C	$0.00467 \times 10^{-4}$
80°C	$0.00351 \times 10^{-4}$
100°C	$0.00274 \times 10^{-4}$

Following gives data of  $\alpha$  and  $\sigma$ :

	$\alpha$
New clean copper pipe or brass pipe	0.011 - 0.012
New clean steel pipe or cast iron pipe	0.013 - 0.014

Fig. 2.3 shows frictional head loss in meter per 100 m in a circular, fouled brass pipe for fresh water at temperature of 30°C ( $\sigma = 0.00805 \times 10^{-4}$ ) :

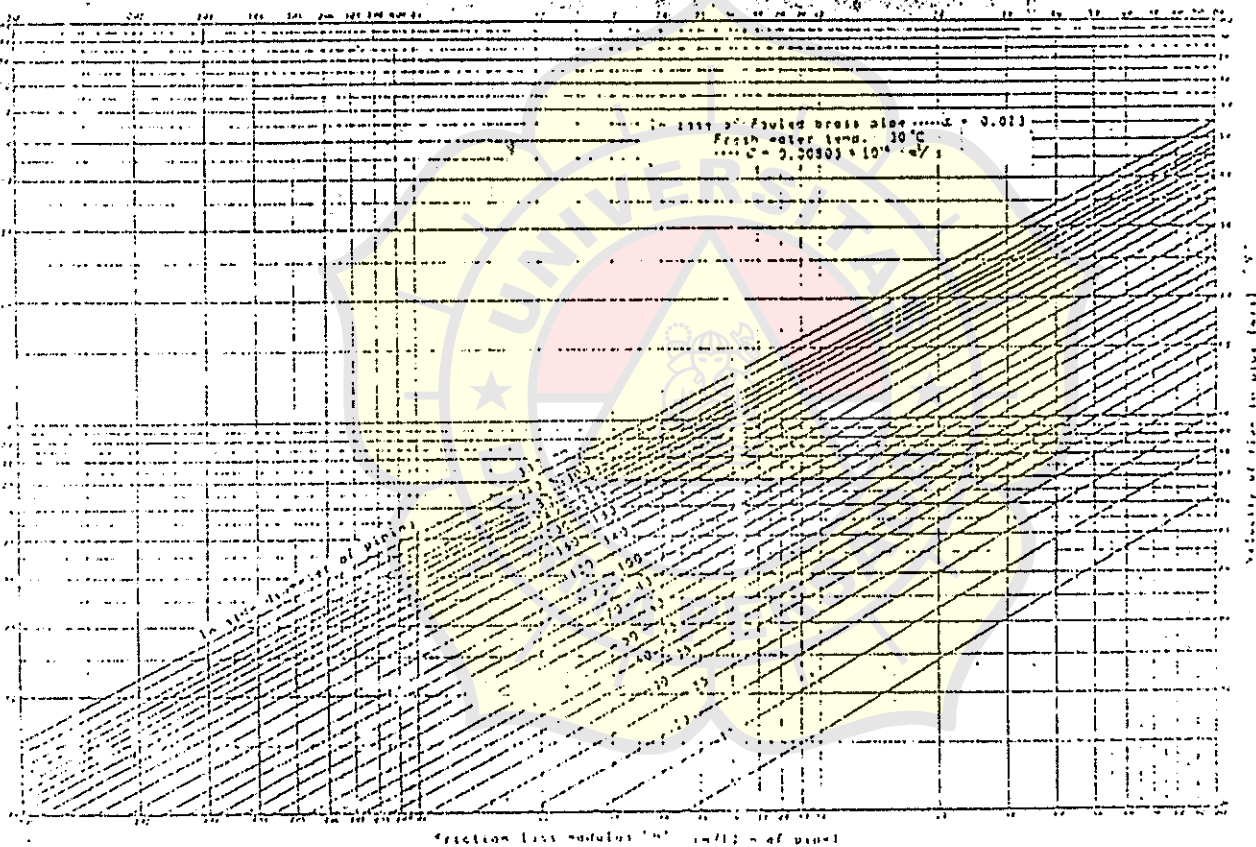


Fig. 2.3 Frictional head loss for water (by new lang's empirical formula)

) Lubricating oil, heavy fuel oil lines

$$h = f \cdot \frac{l}{d} \cdot \frac{v^2}{2g} \dots \dots \dots (2.8)$$

where

- h : Frictional loss head (m)
- l : Length of equivalent straight pipe (m)
- v : Velocity in pipe (m/s)
- d : Internal diameter of pipe (m)
- f : Friction factor

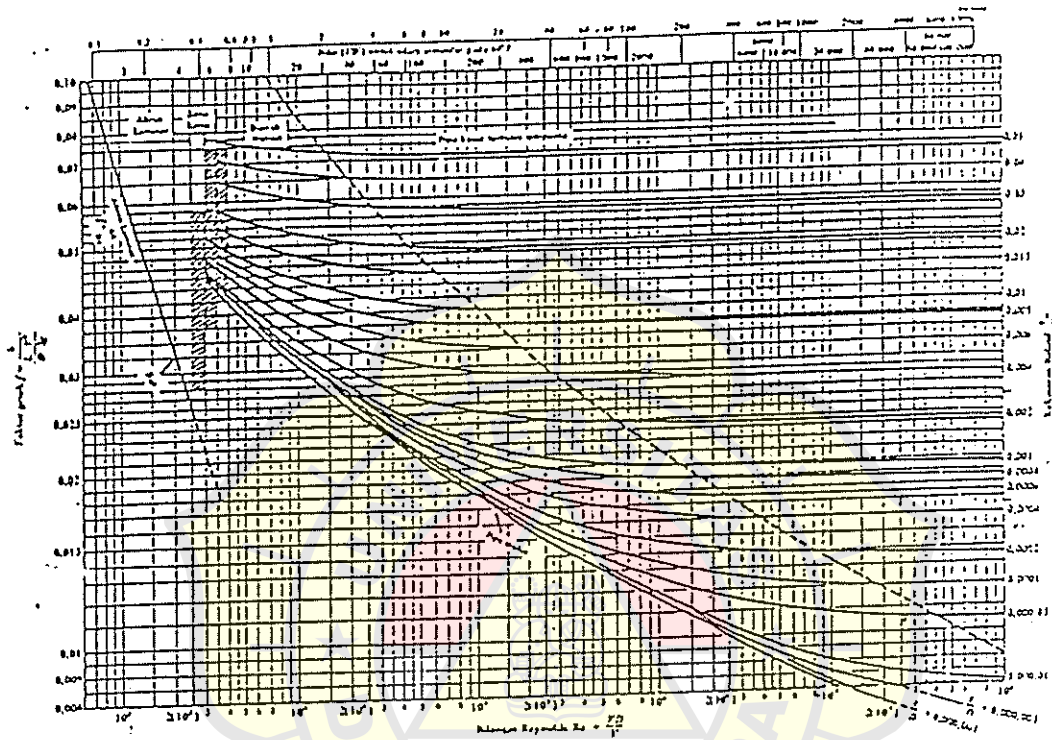
Friction factor is given

for laminar flow:

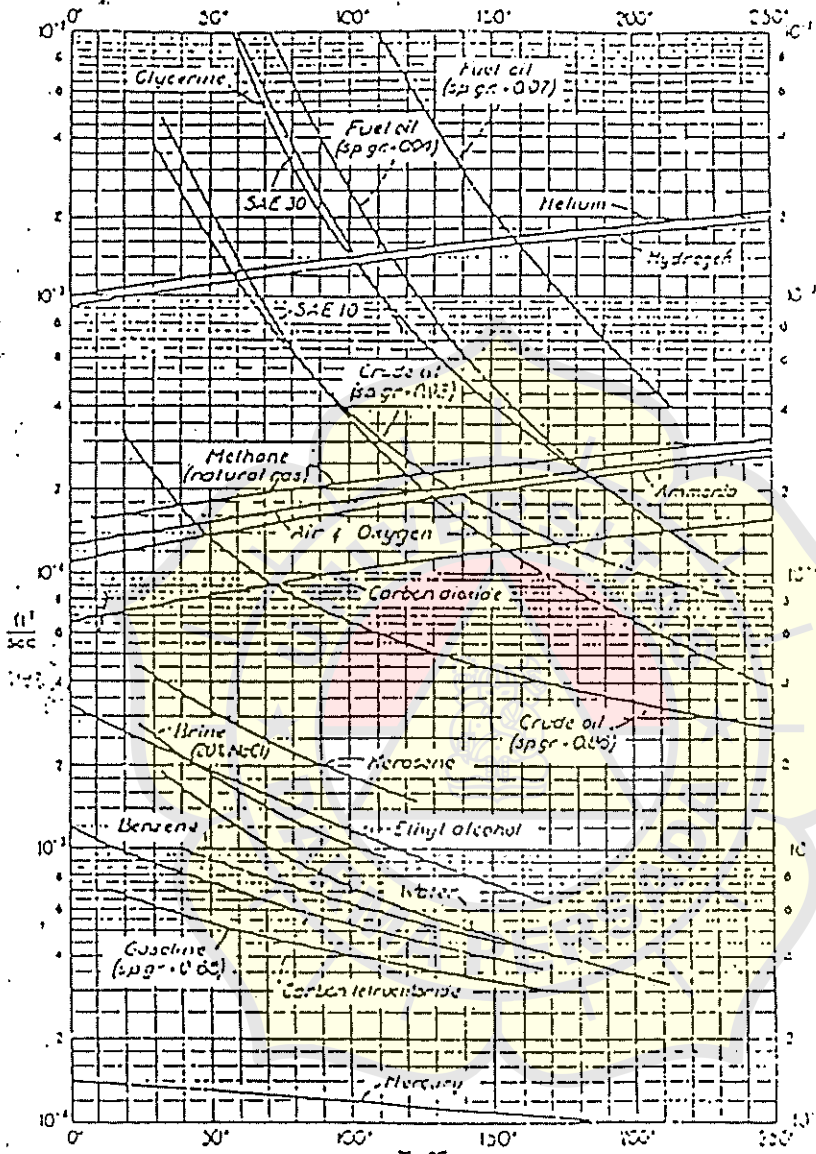
$$f = \frac{64}{R}$$

for turbulence flow: there are several friction factors which have been reported but here, typical ones are shown.

Lampiran 4



Gambar 6.13 Bagan Moody untuk gesekan pipa berdinding halus/kasar.

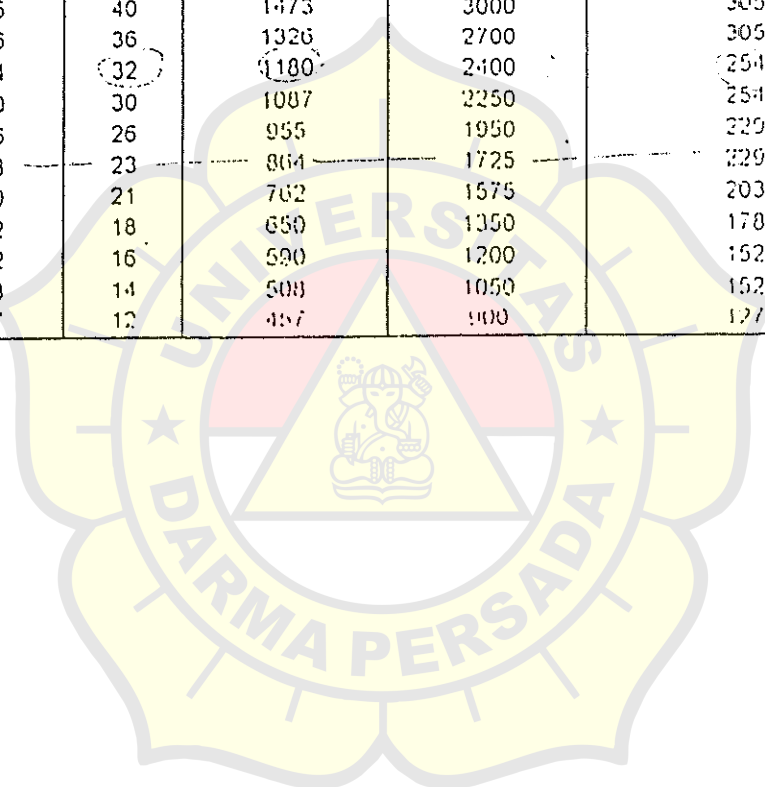


Lampiran. 6 : Grafik viskositas kinematik fluida

Lampiran 2

STANDAR UKURAN BEROCI GUBI ROT (BOARD OF TRADE) ENGLAND

L (m)	B (m)	H (m)	KAPASITAS (M <sup>3</sup> )	JUMLAH ORANG	BERAT SEKOCI (KG)	BERAT ORANG (KG)	BERAT PERLENGKAPAN (KG)	TOTAL BEF (KG)
30	9.00	3.75	607	60	2200	4500	356	7051
29	8.75	3.60	545	54	1976	4050	356	6382
28	8.50	3.50	500	50	1824	3750	330	5904
27	8.25	3.40	454	45	1646	3376	330	5352
26	8.00	3.25	405	40	1473	3000	305	4778
25	7.75	3.10	366	36	1326	2700	305	4331
24	7.50	3.00	324	32	1180	2400	254	3834
23	7.50	2.90	300	30	1087	2250	254	3591
22	7.25	2.75	236	26	955	1950	229	3134
21	7.00	2.70	238	23	864	1725	229	2818
20	6.75	2.60	210	21	762	1575	203	2540
19	6.50	2.50	182	18	650	1350	178	2178
18	6.25	2.40	162	16	590	1200	152	1942
17	6.00	2.30	143	14	508	1050	152	1710
16	5.75	2.30	127	12	457	900	127	1484



DIMENSIONS OF PIPES

Nominal size		Steel Pipe				Aluminium Brass Pipe		Copper Pipe		
(A)	(B)	Outside diam. mm	Thickness (mm)				Outside diam. mm	Thickness (mm)	Outside diam. mm	Thickness (mm)
			Steel I	Steel II	Steel III	Steel IV	Al-Brass I	Al-Brass II	Copper I	Copper II
6	1/8	10.5	-	1.7	2.4	-	1.0	1.2	6.0	1.0
8	1/4	13.8	-	2.2	3.0	-	1.0	1.5	4.0	1.0
10	3/8	17.3	2.3	2.3	3.2	-	1.0	1.5	10.0	1.2
15	1/2	21.7	2.8	2.8	3.7	4.7	1.0	2.0	15.0	1.2
20	3/4	27.2	2.8	2.9	3.9	5.5	1.0	2.0	20.0	1.2
25	1	34.0	3.2	3.4	4.5	6.4	1.5	2.5	25.0	1.6
32	1 1/4	42.7	3.5	3.6	4.9	6.4	1.5	2.5	30.0	1.6
40	1 1/2	48.6	3.5	3.7	5.1	7.2	1.5	3.0	35.0	1.8
50	2	60.5	3.8	3.9	5.5	8.7	1.5	3.0	40.0	1.8
65	2 1/2	76.3	4.2	5.2	7.0	9.5	1.5	3.5	45.0	2.0
80	3	89.1	4.2	5.5	7.6	11.1	1.5	3.5	50.0	2.0
100	4	114.3	4.5	6.0	8.6	13.5	1.5	4.0	55.0	2.0
125	5	139.8	4.5	6.6	9.5	15.9	1.5	4.0	-	-
150	6	165.2	5.0	7.1	11.0	18.3	1.5	4.0	-	-
200	8	216.3	5.8	8.2	12.7	-	-	-	-	-
250	10	267.4	6.6	9.3	12.7	-	-	-	-	-
300	12	318.5	6.9	9.5	12.7	-	-	-	-	-
350	14	369.6	7.9	9.5	12.7	-	-	-	-	-
400	16	406.6	7.9	9.5	12.7	-	-	-	-	-
450	18	457.7	7.9	9.5	12.7	-	-	-	-	-
500	20	508.8	7.9	9.5	12.7	-	-	-	-	-
550	22	558.8	7.9	9.5	12.7	-	-	-	-	-

- Note :
1. Nominal size in inch shows for reference only
  2. Thickness of steel I complies with JIS G3452.
  3. Thickness of steel II complies with JIS G3454 (Schedule 40)
  4. Thickness of steel III complies with JIS G3454 (Schedule 80)

5. Pipes shall be of electric seam welded type in general.
6. Steel pipe except specially mentioned complies with JIS G3457.
7. Aluminium-brass pipe complies with JIS H3300.
8. Copper pipe complies with JIS H3300.
9. Thickness of steel IV complies with JIS G3454 (Schedule 160)

DIAGRAM  $B_p - \delta$  untuk SERIES B4 - 55

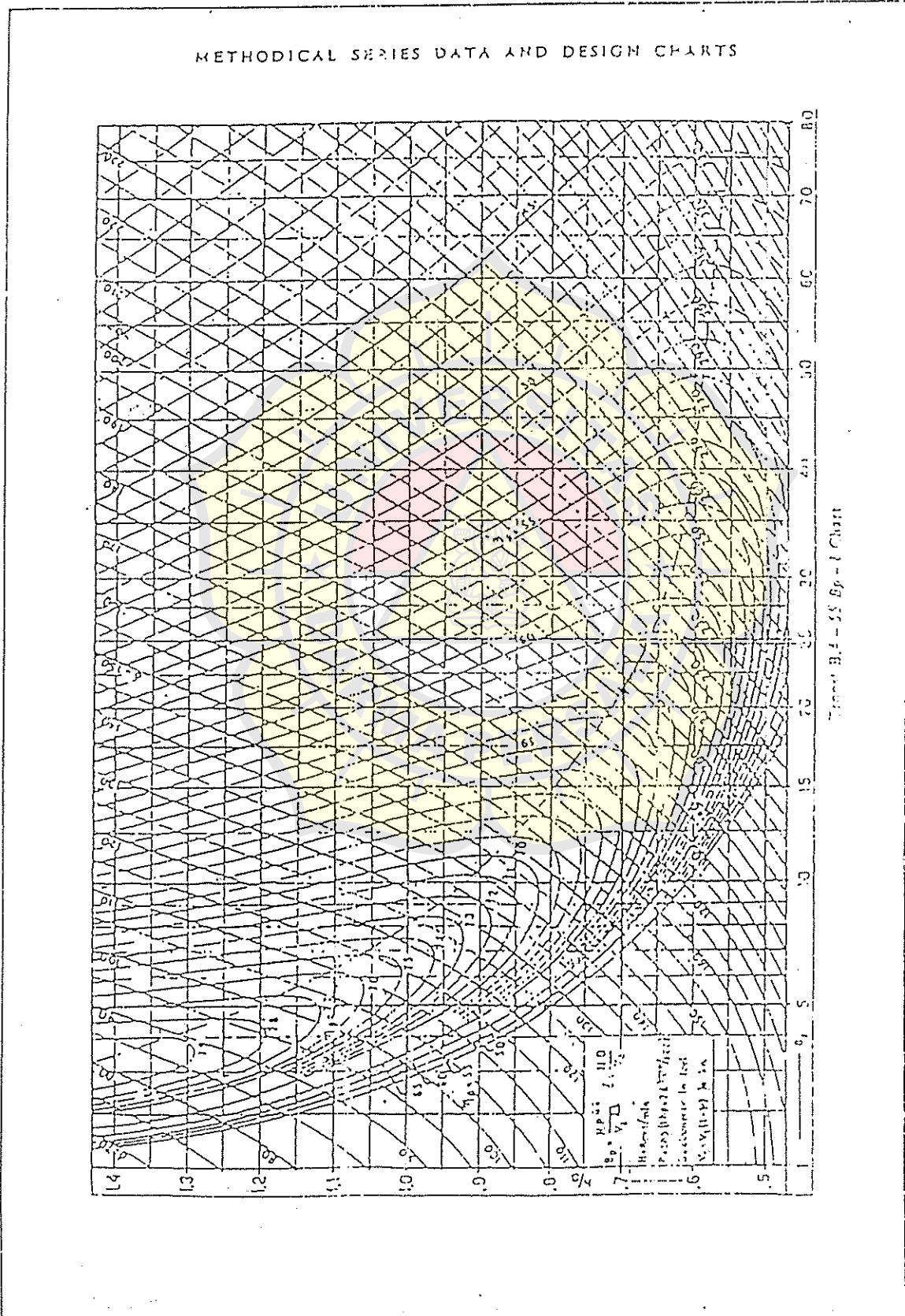
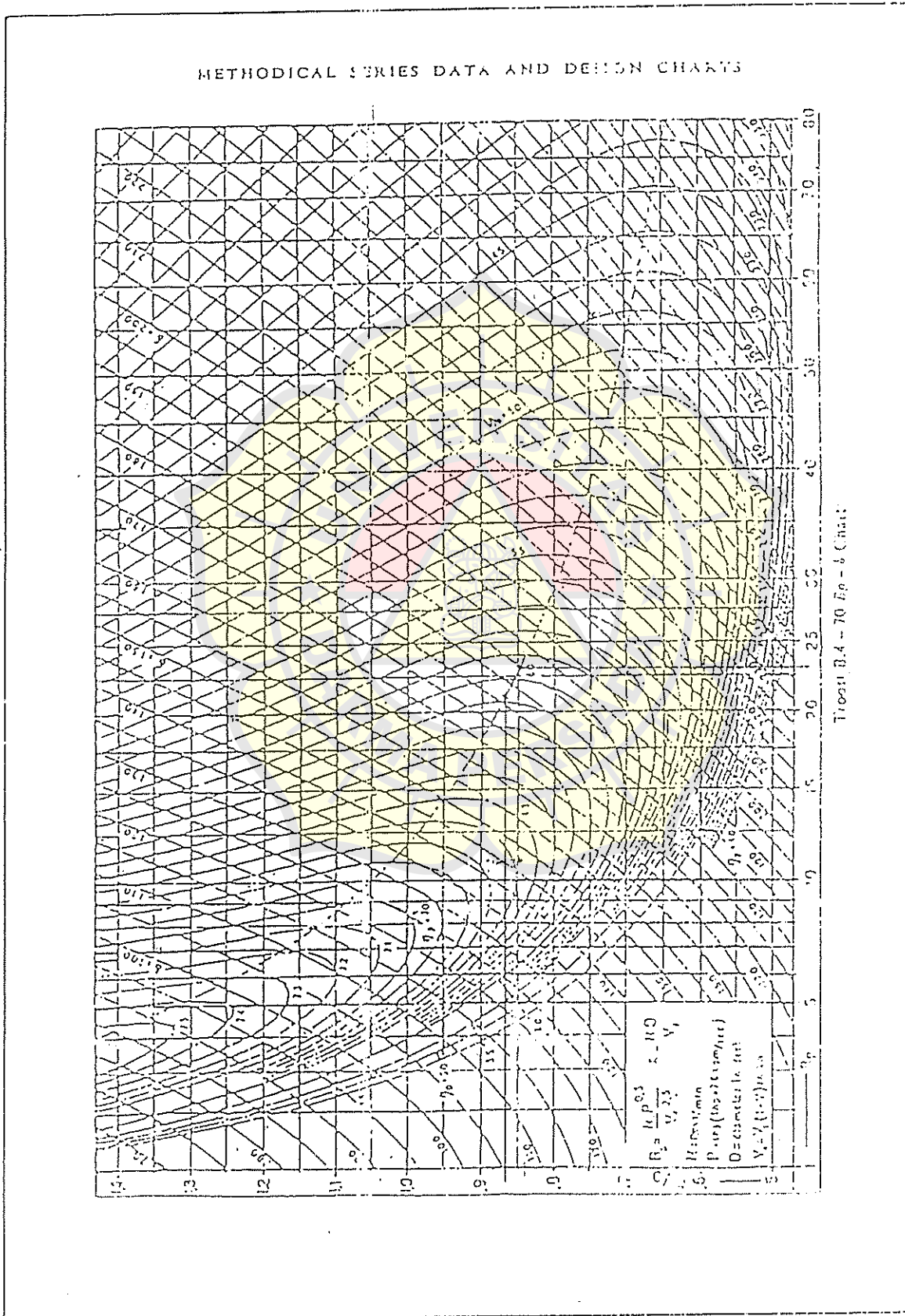




DIAGRAM  $B_p - \delta$  untuk SERIES B4 - 70



TABEL UKURAN SEKOCI

L		B		A		a		b		c		Kapasitas lah. 0 rangk		Block coef = 0,60		Block coef = 0,67		B e r a t	
(m)	(cm)	(m)	(cm)	(m)	(cm)	(m/m)	(m/m)	(m/m)	(m/m)	(m/m)	(m/m)	(m <sup>2</sup> )	(m <sup>2</sup> )	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)
4,18	4,00	1,75	0,70	160	230	360	2,93	10						1470					
4,68	4,50	1,80	0,72	180	230	380	3,50	12						1550					
5,18	5,00	1,80	0,72	200	230	400	3,88	13						2010					
5,68	5,50	1,90	0,75	220	230	420	4,70	16						2150					
6,18	6,00	2,00	0,80	240	230	440	5,76	20						2600					
6,70	6,50	2,15	0,85	260	230	470	7,13	25						3150					
7,20	7,00	2,30	0,90	280	230	500	8,70	30						3750					
7,70	7,50	2,40	0,95	300	225	460	10,26	36					11,45	4260					4730
8,20	8,00	2,50	1,00	320	225	500	12,00	42					13,40	4860					5330
8,72	8,50	2,80	1,15	320	225	560	15,45	44					17,26	6060					6810
8,72	8,50	2,60	1,05	340	225	520	13,92	49					15,25	5530					6190
8,72	8,50	2,80	1,15	340	225	560	16,42	58					18,34	6620					7330
9,22	9,00	2,90	1,15	360	280	560	17,39	61					19,42	6940					7720
9,22	9,00	3,20	1,22	360	290	600	21,08	74					23,54	8240					9250
9,72	9,50	3,05	1,22	360	280	600	21,21	75					23,68	8390					9280
9,72	9,50	3,20	1,22	380	280	600	22,25	76					24,80	8750					9740

STANDART UKURAN SEKOCI BERMOTOR :

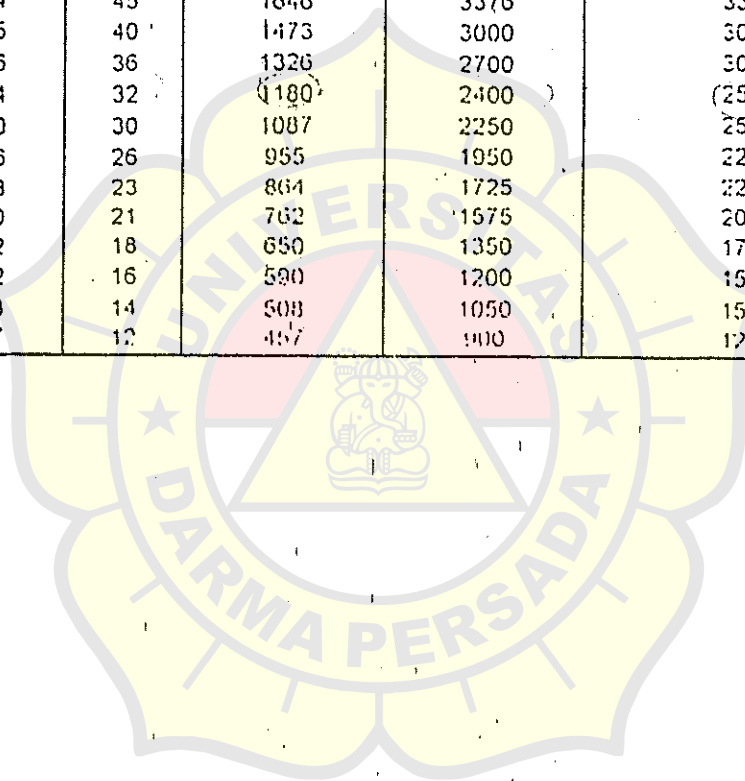
L	B	H	Kapasitas orang	Jumlah koci da-ri kayu	Berat se-koci da-ri plat	Berat se-berat no-tor.	Berat - perlongkap an	Berat total
8,00	2,60	1,16	14,5	1700	1900	820	460	2550
8,50	2,60	1,16	15,4	1800	2100	320	480	2925
9,00	2,70	1,22	17,8	1900	2300	870	510	3450
9,50	2,80	1,22	19,4	2100	2500	1120	530	3750

STANDART UKURAN SEKOCI KERJA :

L <sub>1</sub>	L	B	H	Kapasitas orang	Jumlah orang	Berat ye-numpong	Berat - perlongkap an	Berat se-koci	Berat total
3,60	3,76	1,55	0,6	2,0	4	300	60	300	660
3,80	3,93	1,65	0,66	2,5	5	375	50	360	795
4,00	4,16	1,75	0,70	3,0	6	450	60	420	930
4,50	4,60	1,80	0,78	3,5	7	5,25	70	450	1045
5,00	5,18	1,85	0,72	4,0	8	600	70	500	1170
5,50	5,68	1,90	0,75	4,7	9	675	80	600	1355
6,00	6,18	2,00	0,80	5,8	11	825	80	700	1605

STANDART UKURAN BEKOCI OLEH BOT (BOARD OF TRADE) ENGLAND

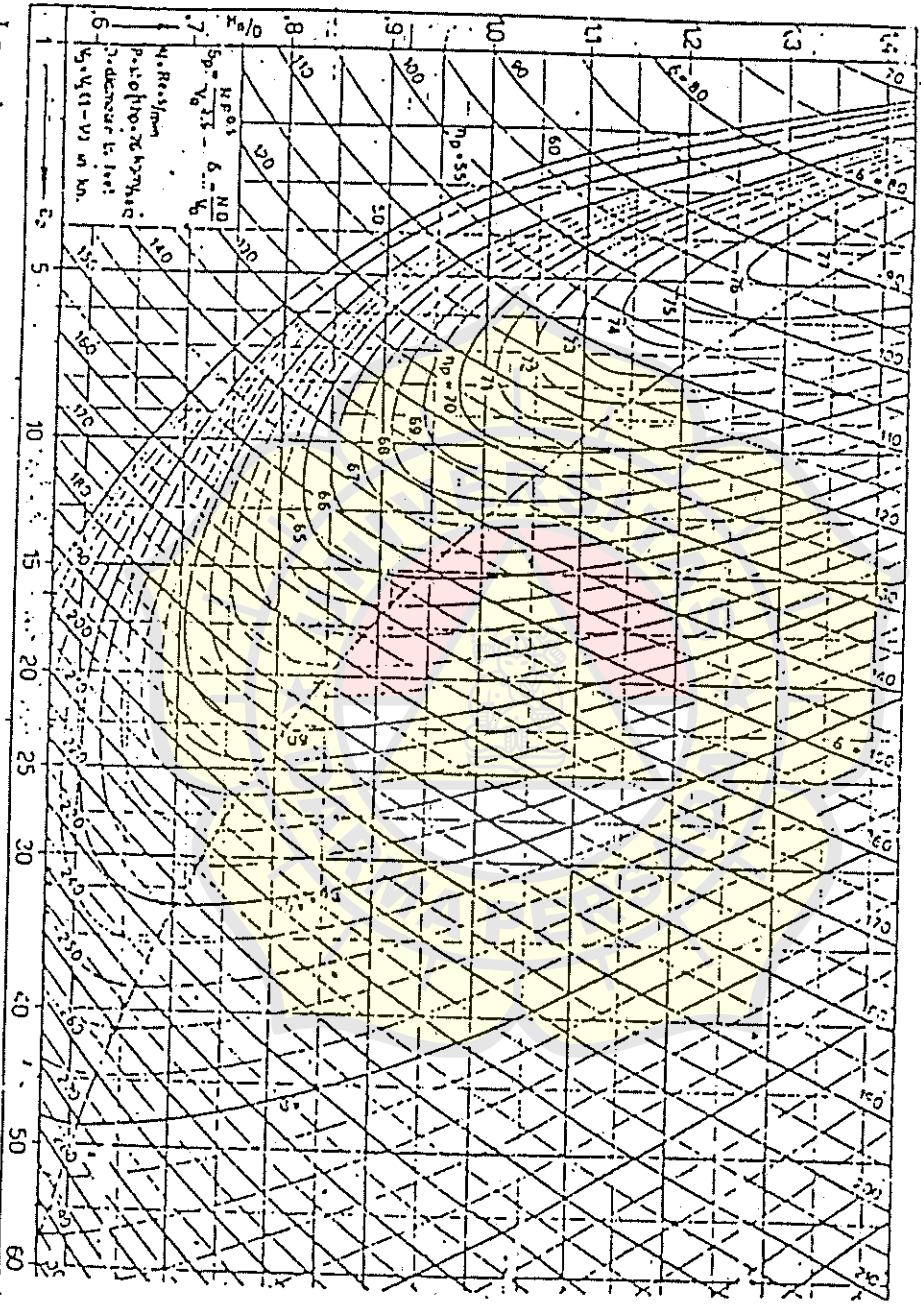
L x B x H (m)	KAPASITAS (M <sup>3</sup> )	JUMLAH ORANG	BERAT SEKOCI (KG)	BERAT ORANG (KG)	BERAT PERLENGKAPAN (KG)	TOTAL BEF (KG)
30 x 9.00 x 3.75	607	60	2205	4500	356	7061
29 x 8.75 x 3.60	545	54	1976	4050	356	5382
28 x 8.50 x 3.50	500	50	1824	3750	330	5904
27 x 8.25 x 3.40	454	45	1646	3376	330	5352
26 x 8.00 x 3.25	405	40	1473	3000	305	4778
25 x 7.75 x 3.15	366	36	1326	2700	305	4331
24 x 7.50 x 3.00	324	32	1180	2400	254	3834
23 x 7.50 x 2.90	300	30	1087	2250	254	3591
22 x 7.25 x 2.75	236	26	955	1950	229	3134
21 x 7.00 x 2.70	238	23	864	1725	229	2818
20 x 6.75 x 2.60	210	21	762	1575	203	2540
19 x 6.50 x 2.50	182	18	650	1350	178	2178
18 x 6.25 x 2.40	162	16	590	1200	152	1942
17 x 6.00 x 2.30	143	14	508	1050	152	1710
16 x 5.75 x 2.30	127	12	457	900	127	1484



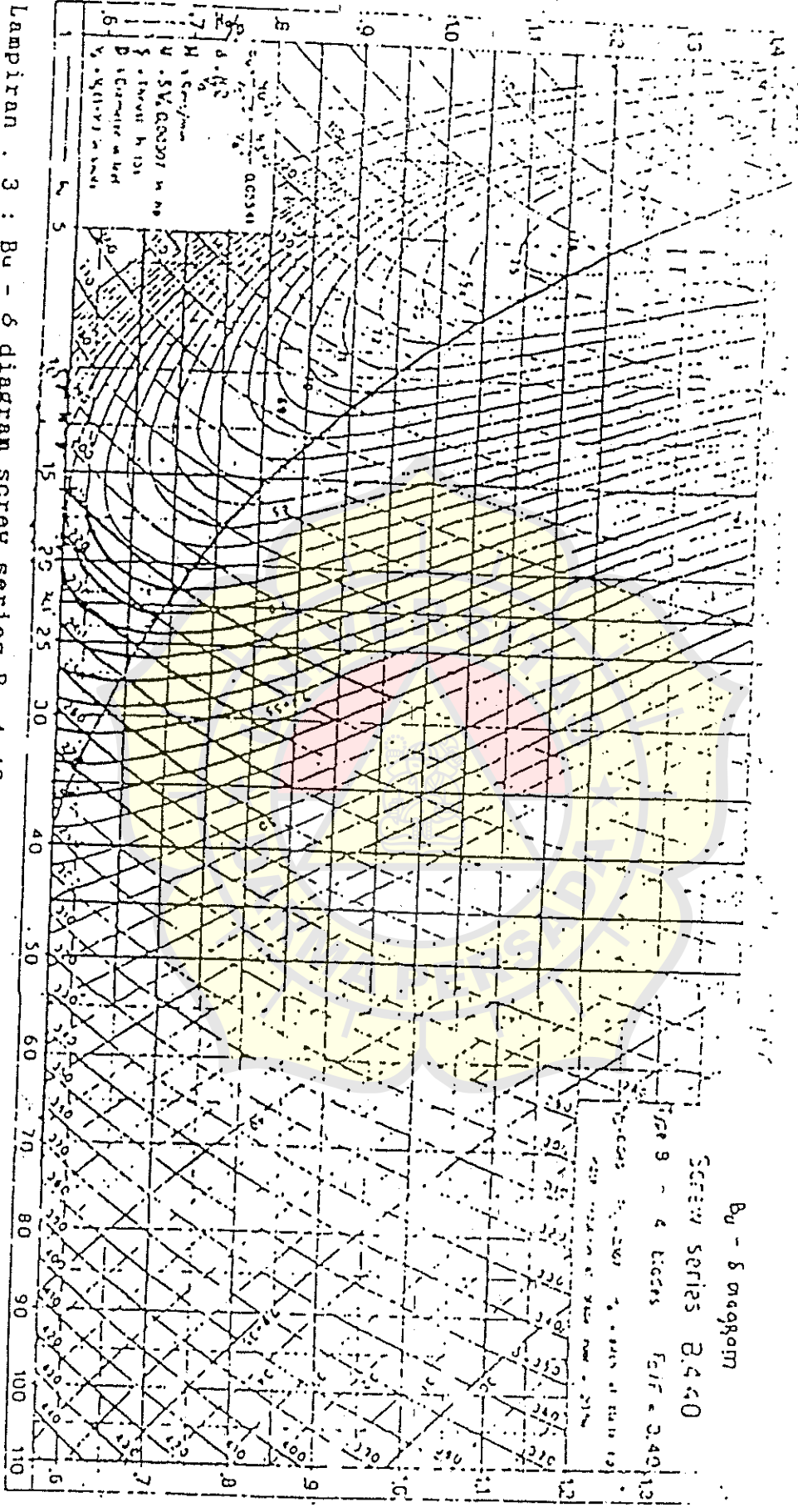
JANGKAR, RANTAI DAN TALI

No utk Reg	Angka Petunjuk Z	Jangkar tanpa tongkal			Rantai						Tali				
		Jumlah jangkar	Berat satu jangkar	Jangkar arus	Rantai kekang untuk haluan			Kawat/rantai arus			Tali laik		Tali tambat		
					Panjang total	Diameter			Panjang	Beban putus	Panjang	Beban putus	Jumlah	Panjang	Beban putus
			kg	m	d1 mm	d2 mm	d3 mm	m	kg	m	kg		m	kg	
101	5	2	120	40	165	12.5			80	6200	180	10000	2	100	3500
102	50-70	2	160	60	220	14	12.5		85	6500	180	10000	2	100	3500
103	70-90	2	240	80	220	16	14		85	7500	180	10000	2	100	3750
104	90-110	2	300	100	547.5	17.5	16		90	8100	180	10000	2	110	4000
105	110-130	2	360	120	247.5	19	17.5		90	9100	180	10000	2	110	4500
106	130-150	2	420	140	275	20.5	17.5		90	10000	180	10000	2	120	5000
107	150-175	2	480	165	275	22	19		90	11000	180	10000	2	120	5500
108	175-205	2	570	190	302.5	24	20.5		90	12000	180	11400	2	120	6000
109	205-240	3	660		302.5	26	22				180	13200	2	120	6600
110	240-280	3	780		330	28	24				180	15300	3	120	7250
111	280-320	3	900		357.5	30	26				180	17700	3	140	8000
112	320-360	3	1020		357.5	32	28				180	21100	3	140	8750
113	360-400	3	1140		385	34	30				180	22800	3	140	9500
114	400-450	3	1290		385	36	32				180	25500	3	140	10250
115	400-500	3	1440		412.5	38	34				180	28200	3	140	11000
116	500-550	3	1590		412.5	40	34				190	31200	3	160	11500
117	550-600	3	1740		440	42	36				190	34500	4	160	12000
118	600-660	3	1920		440	44	38				190	37800	4	160	12500
119	660-720	3	2100		440	46	40				190	41400	4	160	13000
120	720-780	3	2280		467.5	48	42				190	45000	4	170	13500
121	780-840	3	2460		467.5	50	44				190	48600	4	170	14000
122	840-910	3	2640		467.5	52	46	40			190	52000	4	170	14500
123	910-990	3	2820		495	54	48	42			190	55000	4	170	15000
124	990-1080	3	3000		495	56	50	44			190	58000	4	170	15500
125	1080-1140	3	3180		495	58	52	46			190	61000	4	170	16000
126	1140-1220	3	3360		522.5	60	52	48			200	70500	4	180	16000
127	1220-1300	3	3780		522.5	62	54	48			200	75000	4	180	16000
128	1300-1390	3	4050		522.5	64	56	50			200	80100	4	180	20000
129	1390-1480	3	4320		550	66	58	50			200	85200	4	180	21000
130	1480-1570	3	4590		550	68	60	52			220	90400	5	180	22000
131	1570-1670	3	4860		550	70	62	54			220	95000	5	180	23000
132	1670-1790	3	5250		577.5	73	64	56			220	104400	5	190	24000
133	1790-1930	3	5610		577.5	76	66	58			220	113100	5	190	25000
134	1930-2080	3	6000		577.5	78	68	60			220	119100	5	190	26000
135	2080-2230	3	6450		605	81	70	62			240	128400	5	200	27000
136	2230-2380	3	6900		605	84	73	64			240	138300	5	200	28000
137	2380-2530	3	7350		605	87	76	66			240	148200	5	200	29000
138	2530-2700	3	7800		632.5	90	78	68			260	150000	6	200	30000
139	2700-2870	3	8300		632.5	92	81	70			260	150000	6	200	31000
140	2870-3040	3	8700		632.5	95	84	73			260	150000	6	200	32000
141	3040-3210	3	9300		660	97	84	76			280	150000	6	200	33000
142	3210-3400	3	9900		660	100	87	78			280	150000	6	200	34000
143	3400-3600	3	10500		687.5	102	90	80			280	150000	6	200	35000
144	3600-3800	3	11100		687.5	105	92	81			300	150000	6	200	36000
145	3800-4000	3	11700		687.5	107	95	84			300	150000	6	200	37000
146	4000-4200	3	12300		687.5	111	97	87			300	150000	7	200	38000
147	4200-4400	3	12900		715	114	100	87			300	150000	7	200	39000
148	4400-4600	3	13500		715	117	102	90			300	150000	7	200	40000
149	4600-4800	3	14100		715	120	105	92			300	150000	7	200	41000
150	4800-5000	3	14700		742.5	122	107	95			360	150000	7	200	42000
151	5000-5200	3	15400		742.5	124	111	97			300	150000	8	200	44000
152	5200-5500	3	16100		742.5	127	111	97			300	150000	8	200	45000
153	5500-5800	3	16800		742.5	130	114	100			300	150000	8	200	46000
154	5800-6100	3	17500		742.5	132	117	102			300	150000	9	200	50000
155	6100-6400	3	18000		742.5	135	120	107			300	150000	10	200	50000
156	6400-6800	3	20000		770	134	111	107			300	150000	11	200	50000
157	6800-7400	3	21500		770	137	114	110			300	150000	12	200	50000
158	7400-7900	3	23000		770	142	117	117			300	150000	13	200	50000
159	7900-8400	3	24500		770	147	122	122			300	150000	14	200	50000
160	8400-8900	3	26000		770	147	122	122			300	150000	15	200	50000
161	8900-9400	3	27500		770	147	122	122			300	150000	16	200	50000
162	9400-10000	3	29000		770	152	132	132			300	150000	18	200	50000

Lampiran . 4 : Bu - 6 diagram screw series B. 4-55



Lampiran . 3 : Bu - 6 diagram screw series B. 4-40

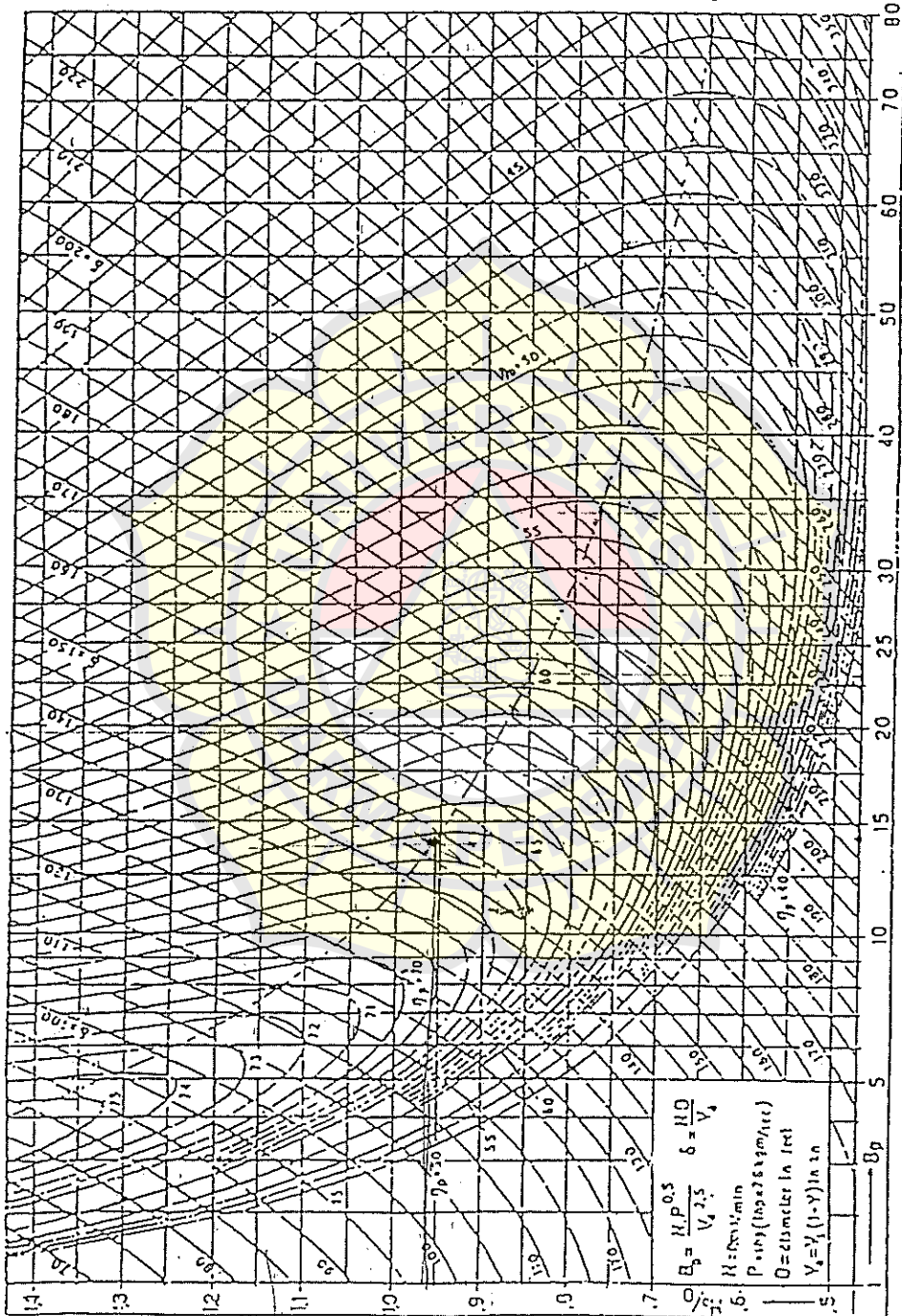


Bu - 6 diagram

SCREW SERIES B. 4.40

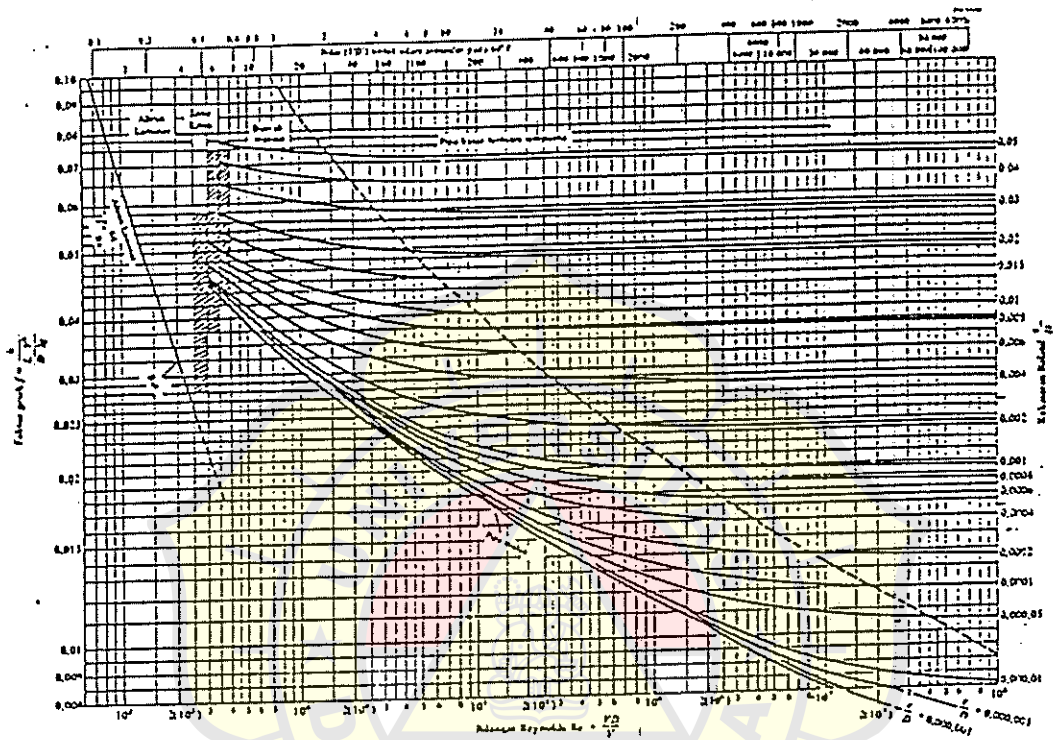
Fig 9 - 4 LINES F&F = 0.40

METHODICAL SERIES DATA AND DESIGN CHARTS

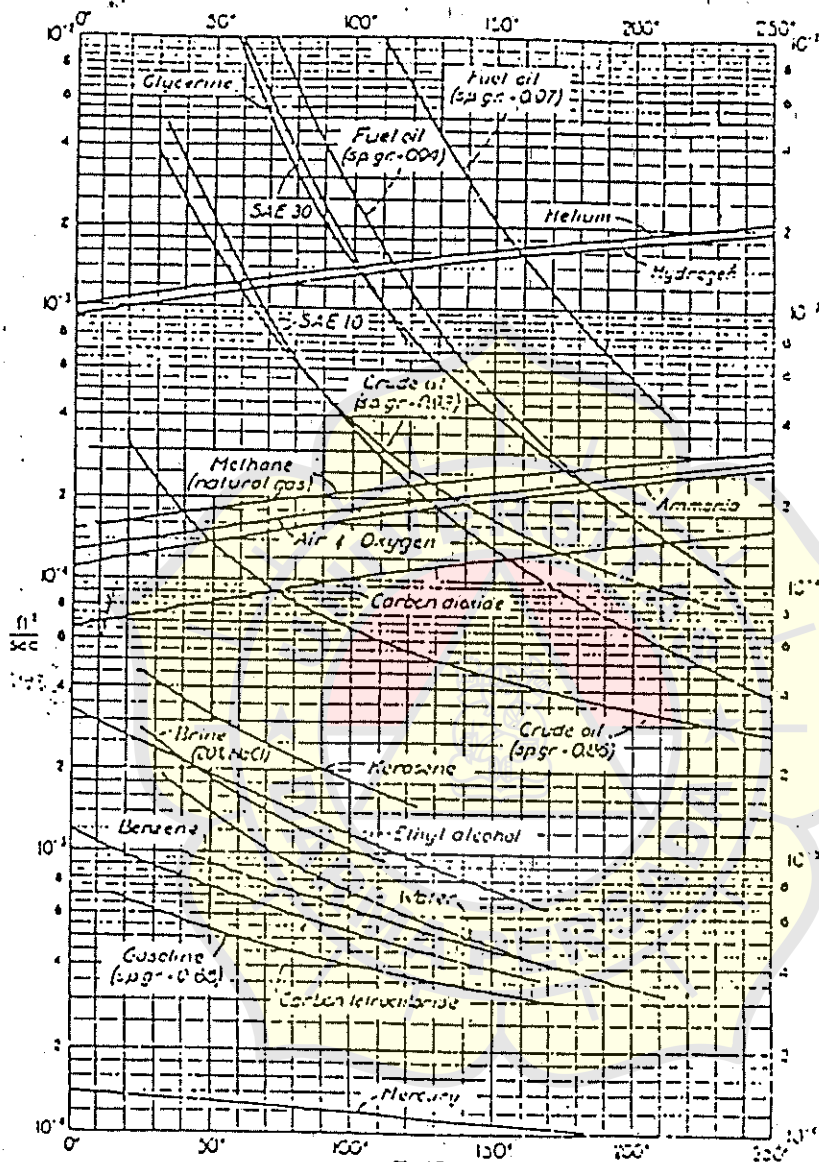


Troost B.4 - 70 Bp - 8 Chart





Gambar 6.13 Bagan Moody untuk gesekan pipa berdinding halus/kasar.



Lampiran. 6 : Grafik viskositas kinematik fluida

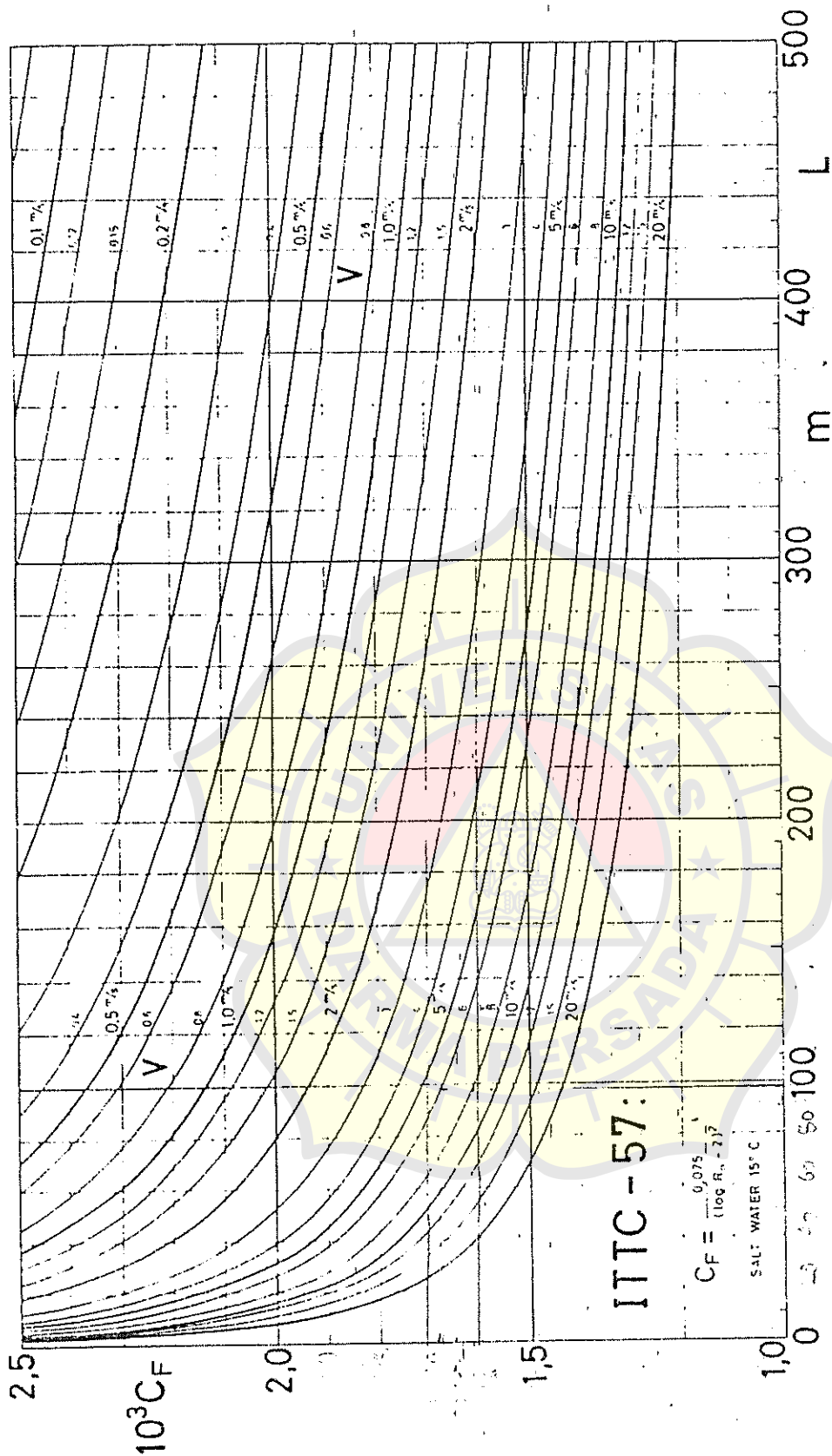


Figure 5.5.14. The frictional resistance coefficient  $C_f$  (according to ITTC 1957) as a function of ship length  $L$  and speed  $V$ .

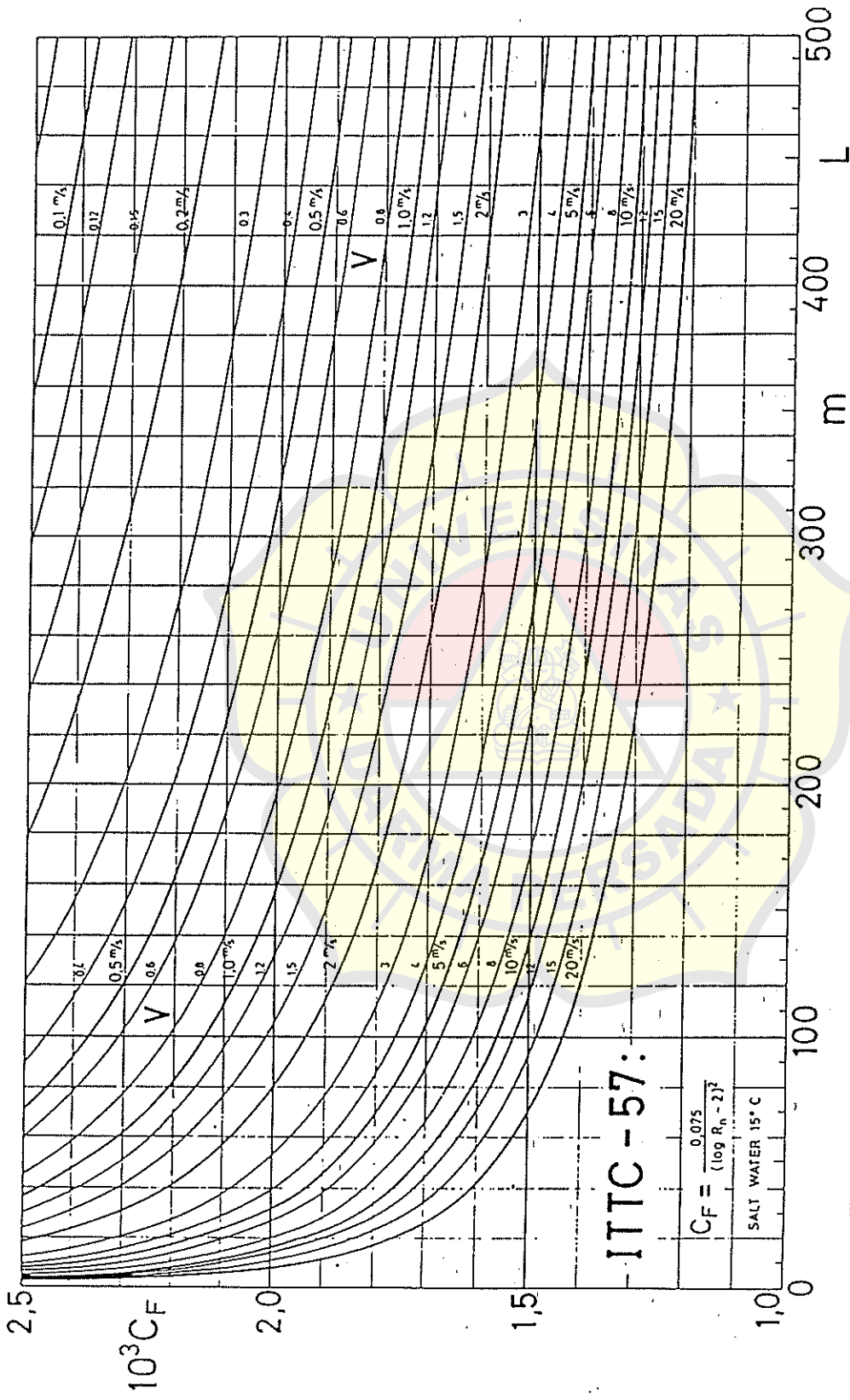
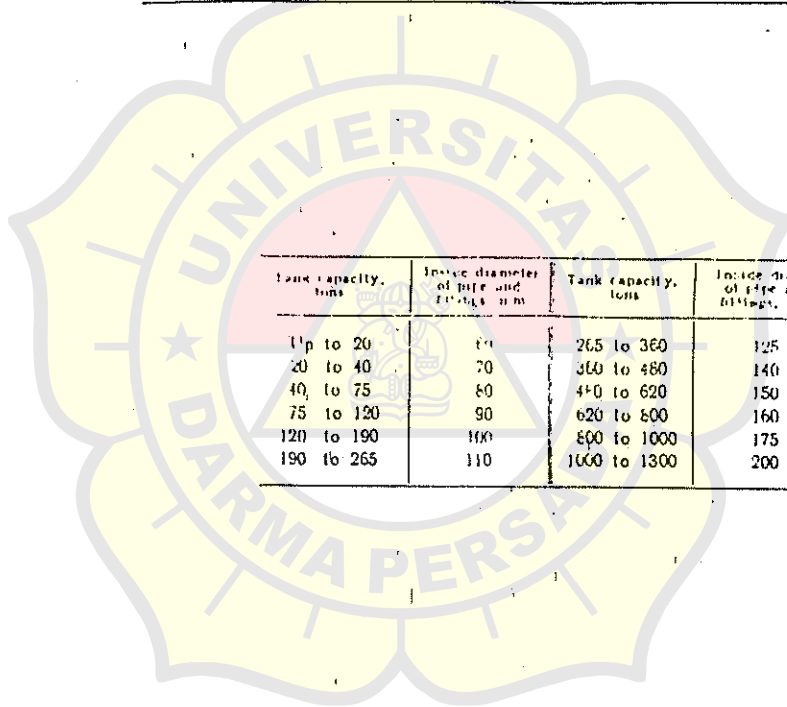


Figure 5.5.14. The frictional resistance coefficient  $C_f$  (according to ITTC 1957) as a function of ship length  $L$  and speed  $V$ .

Pumps

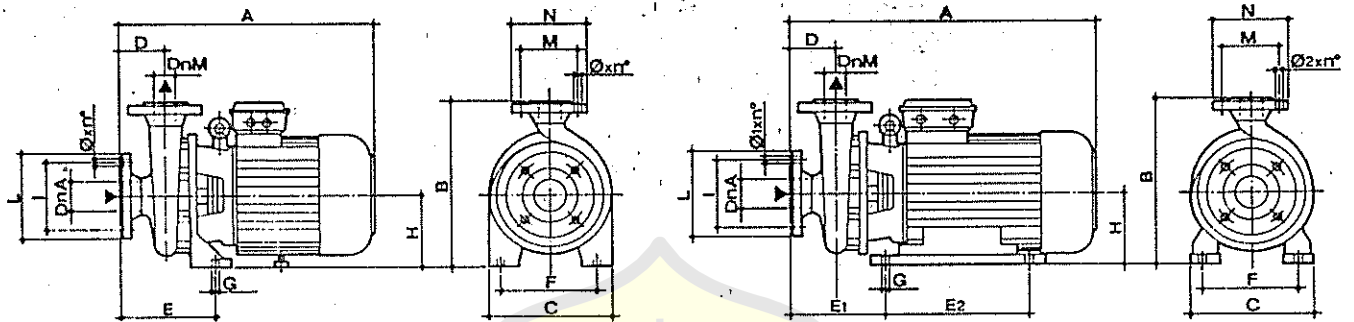
Hose diameter $d_h$ , mm	Hose length $l_h$ , m	Nozzle orifice diameter $d_n$ , mm				Hose diameter $d_h$ , mm	Hose length $l_h$ , m	Nozzle orifice diameter $d_n$ , mm			
		10	13	16	19			10	13	16	19
		Characteristic B						Characteristic B			
50	0	0.121	0.346	0.793	1.577	65	0	0.121	0.346	0.793	1.577
	10	0.119	0.331	0.722	1.320		10	0.1205	0.342	0.776	1.51
	20	0.118	0.318	0.622	1.130		20	0.120	0.339	0.758	1.44
	40	0.114	0.304	0.568	0.882		40	0.1195	0.332	0.726	1.33
	60	0.111	0.274	0.498	0.723		60	0.1185	0.326	0.696	1.23
	80	0.108	0.257	0.442	0.612		80	0.118	0.320	0.669	1.15
	100	0.105	0.241	0.398	0.531		100	0.117	0.314	0.644	1.08



Tank capacity, tons	Inside diameter of pipe and fittings, mm	Tank capacity, tons	Inside diameter of pipe and fittings, mm
10 to 20	60	265 to 360	125
20 to 40	70	360 to 480	140
40 to 75	80	480 to 620	150
75 to 120	90	620 to 800	160
120 to 190	100	800 to 1000	175
190 to 265	110	1000 to 1300	200

Inside diameter of the drainage main, mm	Capacity of each drainage pump, cu m per h	Inside diameter of the drainage main, mm	Capacity of each drainage pump, cu m per h
50	15	133	103
57	19	140	113
64	23	146	124
70	28	152	135
76	34	158	146
82	40	165	158
89	46	171	171
95	53	178	183
103	60	184	197
108	68	190	210
114	76	197	224
120	84	205	240
127	93		

# SINGLE STAGE CENTRIFUGAL PUMPS



K 30-40-50/800 - K 20-25-35/1200'

K 60-70-80/800 - K 30-40-50/1600-K 15-20-30/3000

PUMP TYPE	A	B	C	D	E	E1	E2	F	G	H	I	L	M	N	1'x n°	Ø1x n°	1'2x n°	DNA	DNM	Weight Kg
K 30/800 T	600	385	273	100	210	-	-	212	14	160	160	200	145	185	18 x 4	-	-	80	65	75
K 40/800 T	600	385	273	100	210	-	-	212	14	160	160	200	145	185	18 x 4	-	-	80	65	81
K 50/800 T	600	385	273	100	210	-	-	212	14	160	160	200	145	185	18 x 4	-	-	80	65	87,6
K 60/800 T	717	350	337	100	-	277	364	245	14	200	180	200	145	185	18 x 4	18 x 4	-	80	65	150
K 70/800 T	717	350	337	100	-	277	364	245	14	200	180	200	145	185	18 x 4	18 x 4	-	80	65	157
K 80/800 T	717	350	337	100	-	277	364	245	14	200	180	200	145	185	18 x 4	18 x 4	-	80	65	165
K 20/1200 T	600	385	273	100	210	-	-	212	14	160	160	200	145	185	18 x 4	-	-	80	65	79
K 25/1200 T	600	385	273	100	210	-	-	212	14	160	160	200	145	185	18 x 4	-	-	80	65	85
K 35/1200 T	600	385	273	100	210	-	-	212	14	160	160	200	145	185	18 x 4	-	-	80	65	91
K 30/1600 T	738	340	337	125	-	302	364	245	14	190	180	220	160	200	18 x 8	18 x 4	-	100	80	145
K 40/1600 T	762	340	337	125	-	302	364	245	14	190	180	220	160	200	18 x 8	18 x 4	-	100	80	155
K 50/1600 T	762	340	337	125	-	302	364	245	14	190	180	220	160	200	18 x 8	18 x 4	-	100	80	162
K 15/3000 T	790	470	337	125	-	310	364	245	14	190	210	250	180	220	18 x 8	18 x 8	-	125	100	150
K 20/3000 T	790	470	337	125	-	310	364	245	14	190	210	250	180	220	18 x 8	18 x 8	-	125	100	160
K 30/3000 T	790	470	337	125	-	310	364	245	14	190	210	250	180	220	18 x 8	18 x 8	-	125	100	167

PUMP TYPE	MOTOR SIZE		VOLTAGE	AMPERE	DELIVERY Q = m <sup>3</sup> /h (water with specific gravity 1000 Kg/m <sup>3</sup> )																		
	HP	KW			DELIVERY Q = Litres/min.																		
	50 Hz			TOTAL MANOMETRIC LIFT IN METRES = H																			
K 30/800 T	10	7,35	3-Phase 380/660 V	15-8,7	44	43,5	40,5	38	31	21,5													
K 40/800 T	12,5	9,2	3-Phase 380/660 V	19-11	51,5	51	49	47	41	32,5	21												
K 50/800 T	15	11	3-Phase 380/660 V	23-13,3	59,5	59	56	55	50	42,5	32												
K 60/800 T	20	14,7	3-Phase 380/660 V	31-18	67,5	67	64	62,5	58	50	38												
K 70/800 T	25	18,5	3-Phase 380/660 V	38-21,2	76,5	76	73	72	67,5	60	49												
K 80/800 T	30	22	3-Phase 380/660 V	42-24,3	84	83,5	80,5	78,5	75	68,5	58,5												
K 20/1200 T	10	7,35	3-Phase 380/660 V	16-9,2	33	33	30,5	29,9	27,6	25	21,5	10											
K 25/1200 T	12,5	9,2	3-Phase 380/660 V	19-11	39	39	36	35	33	30,6	27,2	17,5											
K 35/1200 T	15	11	3-Phase 380/660 V	23-13,3	43	43	41,5	41,5	40	37,9	35	25											
K 30/1600 T	20	14,7	3-Phase 380/660 V	31-18	50,5	50,5	49,5	49,5	48,5	47	45	39,5	31										
K 40/1600 T	25	18,5	3-Phase 380/660 V	38-21,2	55	55	54	54	53,5	52	51	47	39										
K 50/1600 T	30	22	3-Phase 380/660 V	42-24,3	61,5	61,5	61	61	60	58,5	57	53	46										
K 15/3000 T	20	14,7	3-Phase 380/660 V	31-18	30,5	30,5	29	29	28	27,5	27	25	22,5	19,5	14								
K 20/3000 T	25	18,5	3-Phase 380/660 V	38-21,2	35	35	34	34	33	32,5	32	30,5	28,6	25,5	21,7	16,4							
K 30/3000 T	30	22	3-Phase 380/660 V	42-24,3	40	40	39,5	39,5	38,5	38,3	38	37	35	32,5	29	24	17,4						

GRAPHICAL SYMBOL	NAME	REMARKS	GRAPHICAL SYMBOL	NAME	REMARKS	GRAPHICAL SYMBOL	NAME	REMARKS
	DRESSER TYPE EXPANSION JOINT			GLOBE			ROSE BOX	
	SLEEVE TYPE EXPANSION JOINT			ANGLE			ROSE PLATE	
	BELLOWS TYPE EXPANSION JOINT			THREE WAY VALVE			BILGE HAT	
	EXPANSION PIPE JOINT	OFFSET BENDER		GLOBE			BELLMOUTH	
	BLANK FLANGE			ANGLE			SEA CHEST	
	SPECTACLE FLANGE			SWING CHECK VALVE			EJECTOR, EDUCTOR, INJECTOR	
	REDUCER			GLOBE			SOUNDING HEAD WITH CAP	
	ORIFICE			ANGLE			SOUNDING HEAD WITH SELF CLOSING VALVE	
	HAND PUMP			BUTTERFLY VALVE			DECK PIECE TYPE SOUNDING HEAD	
	SIGHT GLASS			BUTTERFLY VALVE (REMOTE OPERATED)			AIR VENT PIPE	
	BOSS			GATE VALVE			BONNET TYPE AIR PIPE HEAD (WITH WIRE NET)	
	TRANSMITTER			GLOBE			OIL TRAY, COAMING	
	THERMOMETER			ANGLE			EXHAUST GAS PIPE HEAD	
	PRESSURE GAUGE			COCK			FILLING PIPE HEAD WITH SCREW CAP	
	COMPOUND GAUGE			LOCKED COCK			SCUPPER PLUG	
	ANCHOR PIECE			THREE-WAY COCK L-PORT			WOODEN PLUG	
	GLASS GAUGE			THREE-WAY COCK T-PORT			GRATING PLATE	
	LINE BLINDER			FLOAT CHECK VALVE FOR OVER-FLOW PIPE			DRAIN PLUG (VOID SPACE IN HEAD)	
				BREATHER VALVE			AIR STRAINER	
				GLOBE			AIR HORN	
				ANGLE			MOUTH PIECE WITH HINGED COVER	
				PISTON VALVE			MEGAPHONE	
				SOLENOID VALVE				
				DIAPHRAGM OPERATED VALVE				

DIMENSIONS OF PIPES

Nominal size		Steel Pipe		Thickness (mm)				Aluminium-Brass Pipe		Copper Pipe	
		Outside diam. mm	Steel I	Steel II	Steel III	Steel IV	Al-Brass I	Al-Brass II	Outside diam. mm	Copper I	Copper II
(A)	(B)										
6	1/8	10.5	-	1.7	2.4	-	1.0	1.2	6.0	1.0	1.2
8	1/4	13.8	-	2.2	3.0	-	1.0	1.5	8.0	1.0	1.4
10	3/8	17.3	2.3	2.3	3.2	-	1.0	1.5	10.0	1.2	1.6
15	1/2	21.7	2.8	2.8	3.7	4.7	1.0	2.0	15.0	1.2	1.8
20	3/4	27.4	2.8	2.9	3.9	5.5	1.0	2.0	20.0	1.2	2.0
25	1	34.0	3.2	3.4	4.5	6.4	1.5	2.5	25.0	1.6	2.3
32	1 1/4	42.7	3.5	3.6	4.9	6.4	1.5	2.5	30.0	1.6	2.5
40	1 1/2	48.1	3.5	3.7	5.1	7.2	1.5	3.0	35.0	1.8	2.5
50	2	60.5	3.8	3.9	5.5	8.7	1.5	3.0	40.0	1.8	2.5
65	2 1/2	76.3	4.2	5.2	7.0	9.5	1.5	3.5	45.0	2.0	3.0
80	3	89.1	4.2	5.5	7.6	11.1	1.5	3.5	50.0	2.0	3.0
100	4	114.3	4.5	6.0	8.6	13.5	1.5	4.0	55.0	2.0	3.5
125	5	139.8	4.5	6.6	9.5	15.9					
150	6	165.2	5.0	7.1	11.0	18.2					
200	8	216.3	5.8	8.2	12.7						
250	10	267.4	6.6	9.3	12.7						
300	12	318.5	6.9	9.5	12.7						
350	14	355.6	7.9	9.5	12.7						
400	16	406.4	7.9	9.5	12.7						
450	18	457.2	7.9	9.5	12.7						
500	20	508.0	7.9	9.5	12.7						
550	22	558.8	7.9	9.5	12.7						

- Note :
1. Nominal size in inch shows for reference only
  2. Thickness of steel I complies with JIS G3453.
  3. Thickness of steel II complies with JIS G3454. (Schedule 40)
  4. Thickness of steel III complies with JIS G3454. (Schedule 80)
  5. Pipes shall be of electric seam welded type in general.
  6. Steel pipe except specially mentioned complies with JIS K3300.
  7. Aluminium-Brass pipe complies with JIS K3300.
  8. Copper pipe complies with JIS G3454. (Schedule 160)
  9. Thickness of steel IV complies with JIS K3300.