

Green Technology Asia CO., LTD.

80/28 Moo 2 Tiwanon 48 Rd., T.Thasai A.Muang,
Nonthaburi 11000, Thailand
TEL 0-2580-8339 FAX 0-2952-3397



บริษัท กรีน เทคโนโลยี เอเชีย จำกัด

80/28 หมู่ที่ 2 ถนนติวานนท์ 48 ตำบลท่าทราย
อำเภอเมือง จังหวัดนนทบุรี 11000
โทร. 0-2580-8339 แฟกซ์ 0-2952-3397

Gruppo Aturia



INSTRUCTION MANUAL

Vertical Pump

Electric motor driven Vertical pump

Model	:	ELV-500S
Capacity	:	0.85 m ³ /s.
Total Head	:	5.86 m.
Speed	:	993 rpm.
Electric Motor	:	75 kw.

Electric Pumping Station No. 6 (P6)

Baan Pom Subdistrict, Phra Nakhon Si Ayutthaya District,

Phra Nakhon Si Ayutthaya Province

By

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Technical Data

ข้อที่ 33.1

ข้อที่ 1

VERTICAL AXIAL FLOW PUMP

Model: ELV-500S ข้อที่ 2



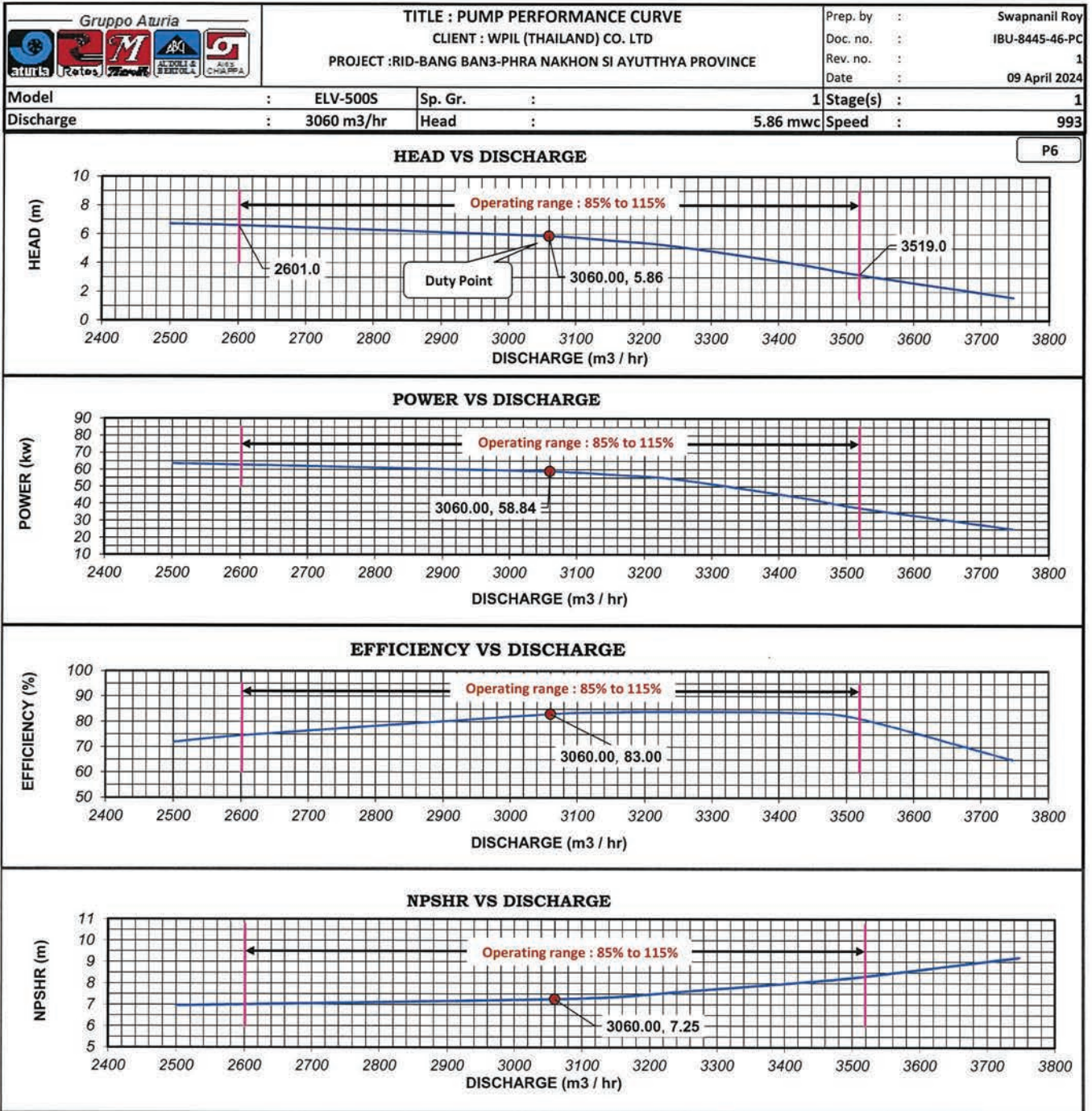
Offer n° :	Offer_BQBS8E00773S_R3	Date : 23-May-24
Customer :	RID_THAILAND	Item : P6
Quantity :	2	Created by : Paolo Tresoldi
REQUESTED DUTIES:		Capacity Q : 3060.00 m3/h
		Head H : 5.50 m
		R.P.M. : 1000 1/min
WORKING DATA AND PUMP CHARACTERISTICS		
Pumped liquid	Water	Pump length from baseplate to suction bell 6.8 m
Temperature	35.00 °C	Discharge Head 600 mm
Density	0.997 kg/dm³	Thrust bearing lubrication Oil
Kinematic viscosity	1.00 mm²/s	Pump/column bearings lubrication Self water
Capacity Q	3060.00 m3/h	Bearings life minimum 100000.00 hr
Head TMH	5.86 m	Impeller type Open
R.P.M.	993.00 1/min	Rotation (pump view from motor side) CCW
Pump input at duty point	59.14 kW	Shaft seal Soft packing PTFE
Bowl input at duty point	58.84 kW	Bowl wear rings Yes
Effective efficiency	83.00 %	Standard elastic coupling Yes
NPSH require	7.25 m	Installation Indoor
Minimum submergence (Max.)	1.50 mm	Ambient temperature 0 +40 °C
Operate Head	2.00-6.50 m	Maximum bowl diameter 851 mm
Column Size	500.00 mm	Gap Below Suction Bell 300 mm
Shaft size	43.00 mm	Shaft alloable torsional vibration stress <1/35
Max particle	90.00 mm	Shaft vibratory torque at maximum load <20%
Axial thrust at duty point	1359.00 kg	Statically and dynamically balanced ISO 1940/1 G 6.3
No. of stages	1.00	Column pipe ANSI/AWWA E101
		Column Connection FLANGE
		Line shaft ANSI/AWWA E101
		Line shaft Type Open
MATERIALS		
Pump bowl	ASTM A48 Class 35	Column pipe ASTM A53 Grade A
-Impeller hub / blades	ASTM A-Type CF8M	-Intermediate bearing Silicon Carbide
-Bowl wear rings	ASTM A-Type CF8M	-Shaft ASTM A-Type 416
-Shaft	ASTM A-Type 416	-Shaft sleeve ASTM A-Type 416
-Bearings	Silicon Carbide	-Bearing bushes Silicon Carbide
-Screws	Stainless Steel	-Shaft coupling Rigid Coupling
Discharge head	ASTM A36	-Screws Stainless Steel
-Bearing housing	ASTM A48 Class 30	Protection
-Elastic coupling	Flexible flange shaft coupling	-Vibration sensor Yes
-Shaft sleeve	ASTM A-Type 416	-RTD PT100 Yes
-Shaft	ASTM A-Type 416	-Float switch Yes
-Screws	Stainless Steel	-Monitoring unit Yes
-Motor stool	ASTM A36	
-Axial bearing	Anti-friction bearing	
ELECTRIC MOTOR (Y/D - Excluded)		
Squirrel Cage Induction Motor	Power: 75.0 kw	Power margine: 1.27
Totally Enclosed Fan Cooled	Speed: 993.0 rpm	26.82%
380Volt / 3Phase / 50Hertz		
DESCRIPTION OF SUPPLY		
Painting : ข้อที่ 19	Performance test :	
-Pre-treatment shot blasting SA 2.5 for all surfaces.	-Witness test in accordance with ISO9906 Liv.2 STANDARD	
-Primer 0.1mm.1 component.	Pump weight:	
-Topcoat for part in contact with medium 0.25 mm. 2 component.	-2300kg	
-Top coat for part not in contact with medium 0.1mm. 1 component.		
-Acrylate Alkyd based coat RAL 5002.		
NOTES		
Sump floor leve: -2.100		
Low water level: -0.300		
Minimum Submergent Level: -0.300 OK		
Shipment	Ex-Works delivery time	Offer Validity

GRUPPO ATURIA SPA
Marco Staderini

ว่าที่ ร.อ.ธรรมณัฐ แก้วบุญส่ง
วิศวกรเครื่องกล สก.๒๕๗๐
โทร. ๐๘๑-๔๔๔-๔๖๖๗

รายละเอียดคุณลักษณะเฉพาะเครื่องสูบน้ำ Page 216 of 966

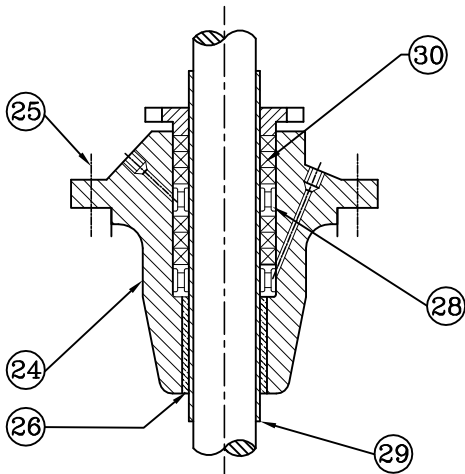
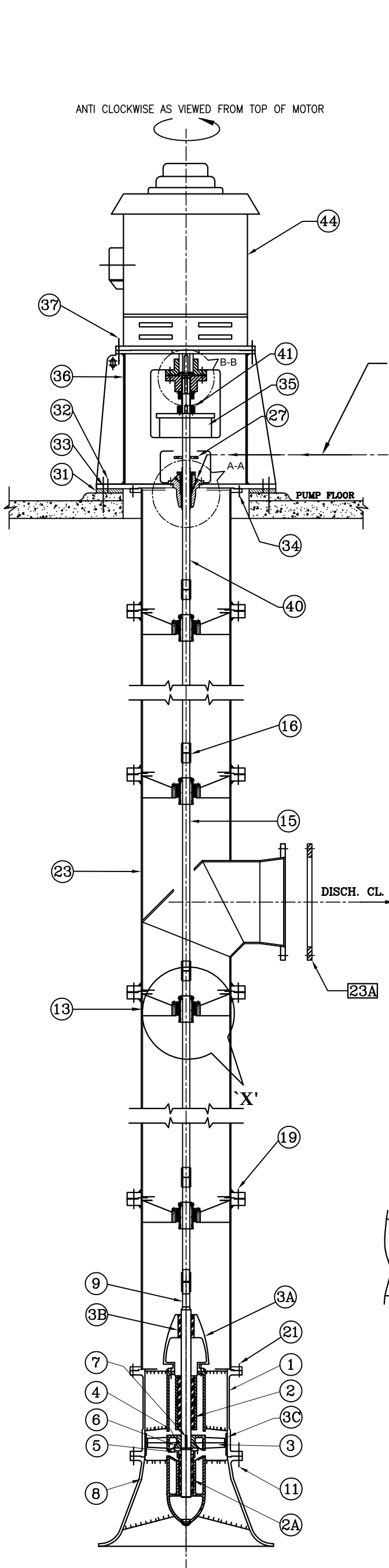




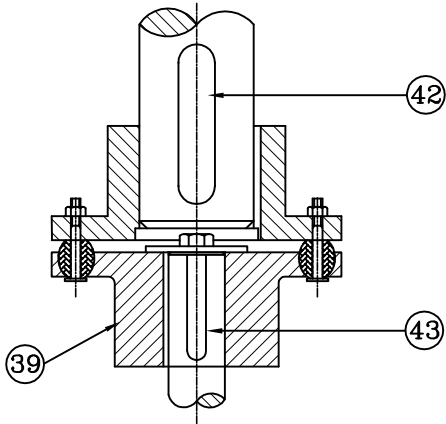

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GRUPPO ATURIA SPA
 Marco Staderini





DETAIL OF PACKING BOX
A-A



DETAIL OF FLEX. COUPLING
B-B

PAINTING NOTE (EPOXY):-
* Pre-treatment shot blasting SA2.5 for all surfaces.

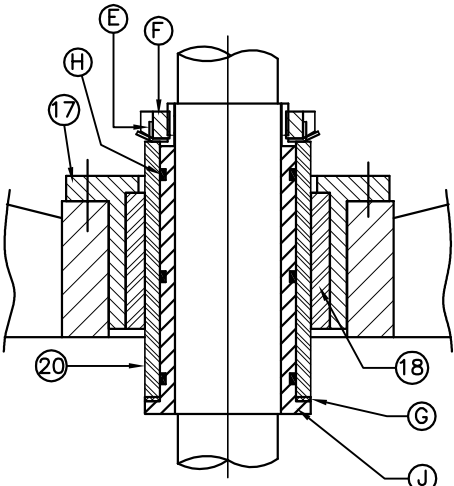
* Primer 0.1mm - 1 coat

* Top coat part in contact with medium 0.25mm - 2 coats

* Top coat part not in contact with medium 0.1mm - 1 coat

* Shade: RAL 9005 Black (Part contact with medium)

* Shade : Acrylate Alkyd based coat, RAL-5011 (Part not contact with medium) ②



ENLARGED VIEW OF 'X'

J	SLEEVE HOLDER	STAINLESS STL.
H	'O' RING	NITRILE RUBBER
G	GASKET	RUBBER
F	LOCK NUT	STAINLESS STL.
E	LOCK WASHER	STAINLESS STL.
SL.NO.	DESCRIPTION	MATERIAL

2	DRAWING REVISED	SG	28.05.24
1	DRAWING REVISED	SG	09.04.24
NO.	REVISION	SIGN	DATE

PUMP THRUST BEARING HOUSING DETAILS		
TYPE	ANTIFRICTION	
AXIAL TH. AT DP (Kg.)	1359	
COOLING WATER INLET LINE	TBH IS AIR COOLED	
OIL	GRADE	VG 68
	QTY.	1.0 LTR.
	OIL TYPE	TURBINE OIL
	MAX. LEVEL FROM TBH BASE	110 MM
	MIN. LEVEL FROM TBH BASE	95 MM

① MOTOR DETAILS :	
MOTOR RATING IN KW	75
MAKE	ABB
SPEED IN RPM (RATED)	990
VOLTS(V)	380
BASE DIA	660
SCOPE	CLIENT

PUMP PERFORMANCE :	
CAPACITY (M ³ /HR.)	3060
TOTAL BOWL HEAD (MWC)	5.86
BOWL EFFICIENCY (%)	83.00
BOWL INPUT AT DP IN KW	58.84
PUMP INPUT AT DP IN KW	59.14
SP. GR. OF WATER	1.00

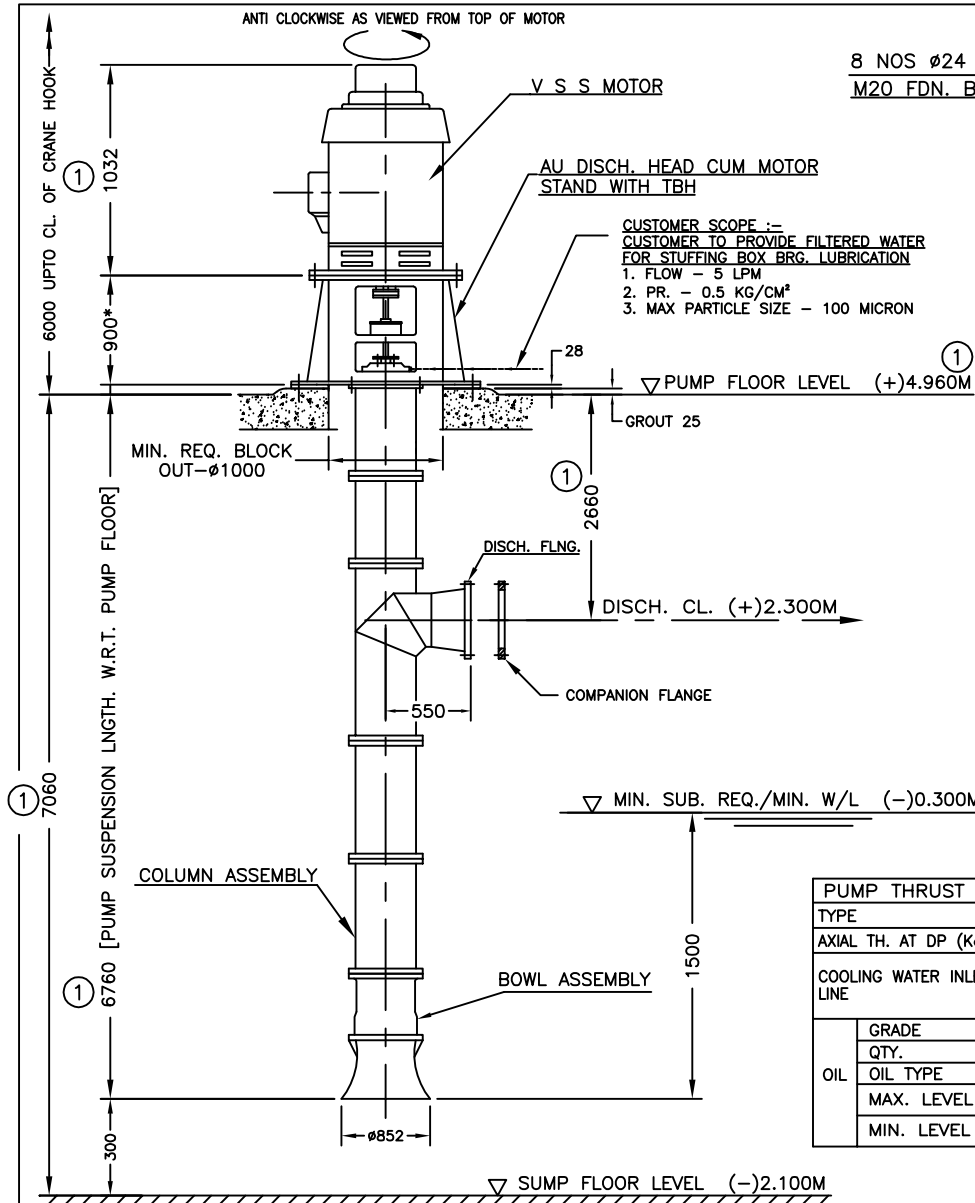
PUMP SPECIFICATION :	
UG DISCH. OUTLET SIZE	600
COLUMN & SHAFT SIZE	500 X 43
PUMP MODEL	ELV-500S
NO. OF STAGE(S)	1 (ONE)
TYPE OF LUBRICATION	SELF WATER
COLUMN TYPE	FLANGED
NO. OF PUMPS	2 (TWO)
IMPELLER TYPE	OPEN

44	MOTOR (VSS)	MANUFACTURER STD.	
43	KEY (HEAD SHAFT)	SS 416	
42	KEY (MOTOR SHAFT)	SS 416	
41	ADJUSTING NUT	STEEL	
40	HEAD SHAFT	ASTM A582 Gr. SS-416	
39	FLEXIBLE COUPLING ASSLY.	CI ASTM A48 CL.35	
37	BOLT & NUT	STAINLESS STEEL	
36	AUXILIARY DISCHARGE HEAD	ASTM A36	
35	THRUST BEARING HOUSING	MANUFACTURER STD.	
34	CAP SCREW	STAINLESS STEEL	
33	FND. BOLTS & NUT, WASHER	CARBON STEEL	
32	CAP SCREW	STAINLESS STEEL	
31	SOLE PLATE	ASTM A36	
30	PACKING	PTFE/TEFLON	
29	SLEEVE	SS 410	
28	LANTERN RING	BRONZE	
27	DEFLECTOR	POLYMER	
26	BUSH	POLYMER/BRONZE	
25	CAP SCREW	STAINLESS STEEL	
24	PACKING BOX	CI ASTM A48 CL.35	
23A	COMPANION FLANGE	ASTM A36	
23	UG ELBOW	ASTM A36	
21	BOLT & NUT	STAINLESS STEEL	
20	SLEEVE	SILICON CARBIDE	
19	BOLT & NUT	STAINLESS STEEL	
18	LINE SHAFT BEARING	SILICON CARBIDE	
17	BUSH RETAINER/CASING	STAINLESS STEEL	
16	SHAFT COUPLING	SS 416	
15	LINE SHAFT	ASTM A582 Gr. SS-416	
13	COLUMN PIPE	ASTM A36	
11	CAP SCREW	STAINLESS STEEL	
9	PUMP SHAFT	ASTM A582 Gr. SS-416	
8	SUCTION BELL	CI ASTM A48 CL.35	
7	KEY	SS 410	
6	CAP SCREW	STAINLESS STEEL	
5	THRUST RING RETAINER	SS 410	
4	THRUST RING	SS 410	
3C	CASING LINER	STAINLESS STEEL	
3B	BUSH	BRONZE	
3A	DIFFUSER CONE	CI ASTM A48 CL.35	
3	PROPELLER	SS CF8M	
2A	BUSH (SB)	BRONZE	
2	BUSH (DB)	CERAMIC/SILICON CARBIDE	
1	DISCHARGE BOWL	CI ASTM A48 CL.35	
SL. NO.	DESCRIPTION	MATERIAL	REMARKS

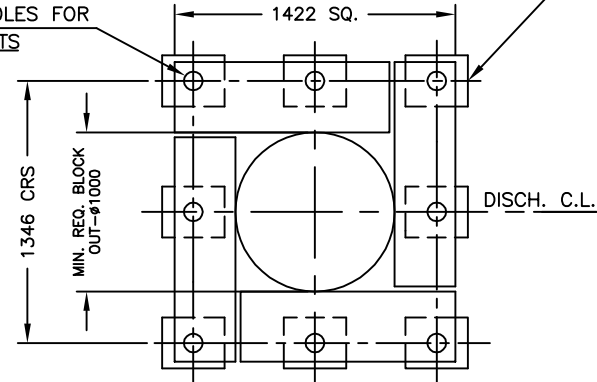
BILL OF MATERIALS

Gruppo Aturia GRUPPO ATURIA	SCALE : NONE		
		NAME	DATE
	DRAWN	S.GHATAK	19.03.24
	CHECKED	S.GHATAK	19.03.24
SECTIONAL DRAWING FOR VERTICAL TURBINE PUMP	APPROVED	S.GHATAK	19.03.24
	DRAWING NO.	REV.	
	SK-12306-C	2	
CLIENT : WPIL (THAILAND) CO. LTD.			
PROJECT : RID_BANG BAN3_PHRA NAKHON SI AYUTTHAYA PROVINCE			

SECTIONAL DRAWING FOR VERTICAL TURBINE PUMP
CLIENT : WPIL (THAILAND) CO. LTD.
PROJECT : RID_BANG BAN3_PHRA NAKHON SI AYUTTHAYA PROVINCE



8 NOS Ø24 HOLES FOR
M20 FDN. BOLTS



PLAN OF SOLE PLATE AT PUMP FLOOR
LEVEL (+)4.960M ①

DISCH. FLNG DRILLING
DETAILS AS PER EN:1092
PN:10. 'FF'

SIZE	600 NB
OD	780
PCD	725
NO OF BOLT HOLES	20
HOLE DIA	30
FLNG. THK.	28

①

MOTOR DETAILS :

MOTOR RATING IN KW	75
MAKE	ABB
SPEED IN RPM (RATED)	990
VOLTS(V)	380
BASE DIA	660
SCOPE	CLIENT

PUMP PERFORMANCE :

CAPACITY (M ³ /HR.)	3060
TOTAL BOWL HEAD (MWC)	5.86
BOWL EFFICIENCY (%)	83.00
BOWL INPUT AT DP IN KW	58.84
PUMP INPUT AT DP IN KW	59.14
SP. GR. OF WATER	1.00

PUMP SPECIFICATION :

UG DISCH. OUTLET SIZE	600
COLUMN & SHAFT SIZE	500 X 43
PUMP MODEL	ELV-500S
NO. OF STAGE(S)	1 (ONE)
TYPE OF LUBRICATION	SELF WATER
COLUMN TYPE	FLANGED
NO. OF PUMPS	2 (TWO)
IMPELLER TYPE	OPEN

①

LOAD DATA :

STATIC LOAD	1) WT. OF MOTOR (Apprx.)	930	↓
	2) WT. OF EMPTY PUMP	2580	↓
	3) TOTAL DEAD WEIGHT	3510	↓
DYNAMIC LOAD (Kg.)	1) RESULTANT VERTICAL LOAD ON FOUNDATION(MAX.) (F _v , DISTRIBUTED OVER SOLE PLATE)	5469	↓
	2) RESULTANT HORIZONTAL LOAD ON FOUNDATION(MAX.) (F _h , ACTING ALONG PUMP DISCH. CL. IN REVERSE DIRECTION TO FLOW)	2501	←
GD ² VALUE (Kg.-M ²)	PUMP	4.25	

PUMP THRUST BEARING HOUSING DETAILS			
TYPE		ANTIFRICTION	
AXIAL TH. AT DP (Kg.)		1359	
COOLING WATER INLET LINE		TBH IS AIR COOLED	
OIL	GRADE	VG 68	
	QTY.	2.25 LTR.	
	OIL TYPE	TURBINE OIL	
	MAX. LEVEL FROM TBH BASE	110 MM	
	MIN. LEVEL FROM TBH BASE	95 MM	

NOTES :-

- 1) PUMP HOUSE NATURAL FREQUENCY TO BE ADEQUATELY AWAY FROM PUMP ROTATIONAL SPEED.
- 2) ALL DIMENSIONS ARE IN 'MM' UNLESS OTHERWISE SPECIFIED.
- 3) ' * ' MARKED DIMENSION MAY VARY DURING DETAIL ENGINEERING.
- 4) FLOW QUALITY AT BELL-MOUTH ENTRY SHOULD BE VORTEX FREE AS PER HIS NORMS.

1	REVISED AS PER COMMENTS RCVD. DTD. 29.03.24	SG	09.04.24
NO.	REVISION	SIGN	DATE



GRUPPO ATURIA

GENERAL ARRANGEMENT DRAWING FOR VERTICAL TURBINE PUMP
WITH UNDERGROUND DISCHARGE

CLIENT : WPIL (THAILAND) CO. LTD.

PROJECT : RID_BANG BAN3_PHRA NAKHON SI AYUTTHAYA
PROVINCE

SCALE : NONE

	NAME	DATE
DRAWN	S. GHATAK	19.03.2024
CHECKED	S. GHATAK	19.03.2024
APPROVED	S. GHATAK	19.03.2024

DRAWING NO.	REV.
SK-12305-B	1

ข้อที่ 11, 13, 13.9, 13.19, 13.29, 33.2

ข้อที่ 13.1

IEC LV Motors		Technical Data Sheet - DOL		ABB		
Project		Location				
Department/Author NP		Customer name		Customer ref		
Our ref.		Rev/Changed by A		Date of issue 8/16/2023		
		Saving ident untitled.xlsm		Item name 1.00001		
				Pages 1(3)		
No.	Definition	Data	Unit	Remarks		
1	Product	TEFC, 3-phase, squirrel cage induction motor				
2	Product code	3GBP 313 230-BDM		Calc. ref.	3GZF021031-132	
3	Type/Frame	M3BP 315SMC 6				
4	Mounting	IM3011, V1(flange)		IEC 60034-7		
5	Rated output P _N	75	kW			
6	Service factor	1				
7	Type of duty	S1(IEC) 100%				
8	Rated voltage U _N	380	VD	± 5 % (IEC 60034-1)		
9	Rated frequency f _N	50	Hz	± 2 % (IEC 60034-1)		
10	Rated speed n _N	993	r/min			
11	Rated current I _N	143	A			
12	No-load current	40	A			
13	Starting current I _s /I _N	6.3		Meet IEC 60034-12, N _L (H at 60 Hz)		
14	Nominal torque T _N	721	Nm			
15	Locked rotor torque T _s /T _N	2				
16	Maximum torque T _{max} /T _N	2.5				
17	Minimum torque T _{min} /T _N	1.8				
18	Speed at minimum torque	800	r/min			
Load characteristics (IEC 60034-30-1:2014)		Load %	Current A	Efficiency %	Power factor	
19	PLL determined from residual loss	100	143	95.4 / IE4	0.84	
20		75	110	95.6	0.81	
21		50	80.7	95.4	0.74	
22		Start	901		0.32	
23	Maximum starting time from hot	33	s			
24	Maximum starting time from cold	60	s			
25	Insulation class / Temperature class	F / B (155°C/80°C)		IEC 60085, VPI process		
26	Ambient temperature	40	°C			
27	Altitude	1000	m.a.s.l.			
28	Enclosure	IP55				
29	Cooling system	IC411 self ventilated				
30	Bearing DE/NDE	6319/C3 - 6316/C3				
31	Type of Grease	lithium complex base				
32	Sound pressure level (LP dB(A) 1m)	67	dB(A)	at load		
33	Moment of inertia J = ¼ GD2	4.9	kg-m2			
34	Balancing					
35	Vibration class	A		IEC 60034-14		
36	Position of terminal box	Top				
37	Terminal box entries; no, dimens.	4*90° turnable terminal box		IP55		
38	Number of power terminals					
39	Direction of rotation	CW or CCW				
40	Weight of rotor	303	kg			
41	Total weight of motor	1000	kg			
42	Dimension drawing no.					
43	Maximum number of starts	2000 / year				
44	Number of consec. Starts	3 / 2 (cold/hot)				
45						
Ex-motors						
46						
47						
48						
Option Variant Codes / Definition						
+ Pt100 3-wire in Bearings DE,NDE		+ SPM-Nipple at Bearing DE,NDE for Shock-Pulse Measuring				
+ Pt100 3-wire in stator winding, 1 per phase		+ NDE Insulation Bearing				
+ Aluminum cooling fan		+ Stator winding and Rotor winding : Copper				
+ Painting system C5M acc. to ISO 12944-2:1998 / Special paint color, standard grade (RAL 5002)		+ Insulated bearing at N-End				
+ Grease valve/SPM nipples, Grease nipples, Acid proof bolts : Stainless steel		+ Space Heater 200v. 50Hz.				
Remarks:						
Data based on situation 7/13/2022						
All data subject to tolerances in accordance with IEC						
Guaranteed values on request						

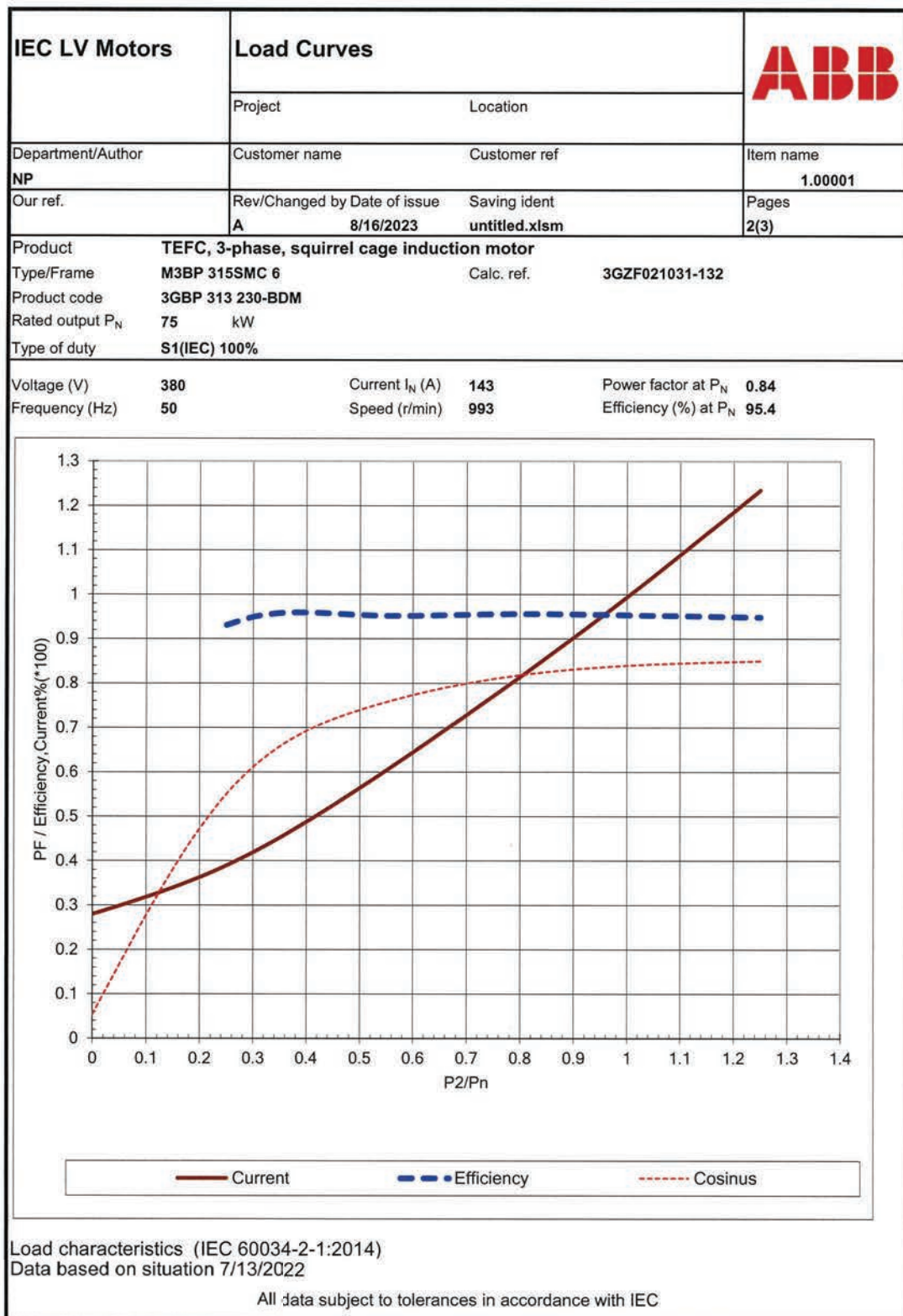
ข้อที่ 13.12, 13.28

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วิศวกรเครื่องกล สก.๒๙๗๐
โทร. ๐๘๑-๔๔๔-๔๖๗๗



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Contact person: Matthaporn Payhan
Position: Sales Manager
Department: Motion
Company: ABB Automation (Thailand) Co., Ltd.
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1 South Sathorn Rd., Thungmahamek, Sathorn,
Bangkok 10120, Tel: 02-645-1000
E-mail: Matthaporn.payhan@th.abb.com
Date: 10-May-24
Original is held at ABB office

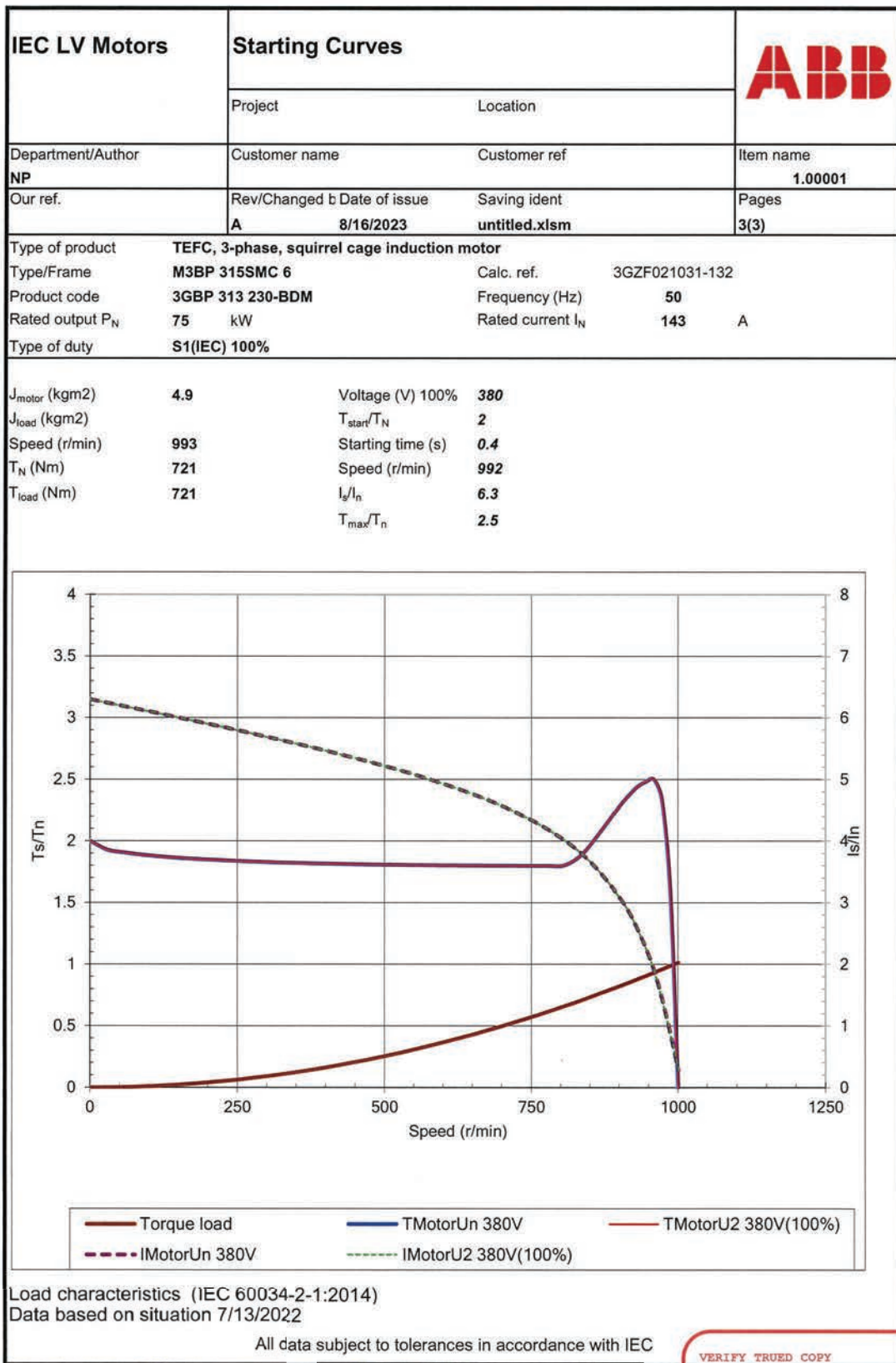


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Bangkok 10120. Tel: 02-665-1000
E-mail: Matthagorn.payhan@th.abb.com
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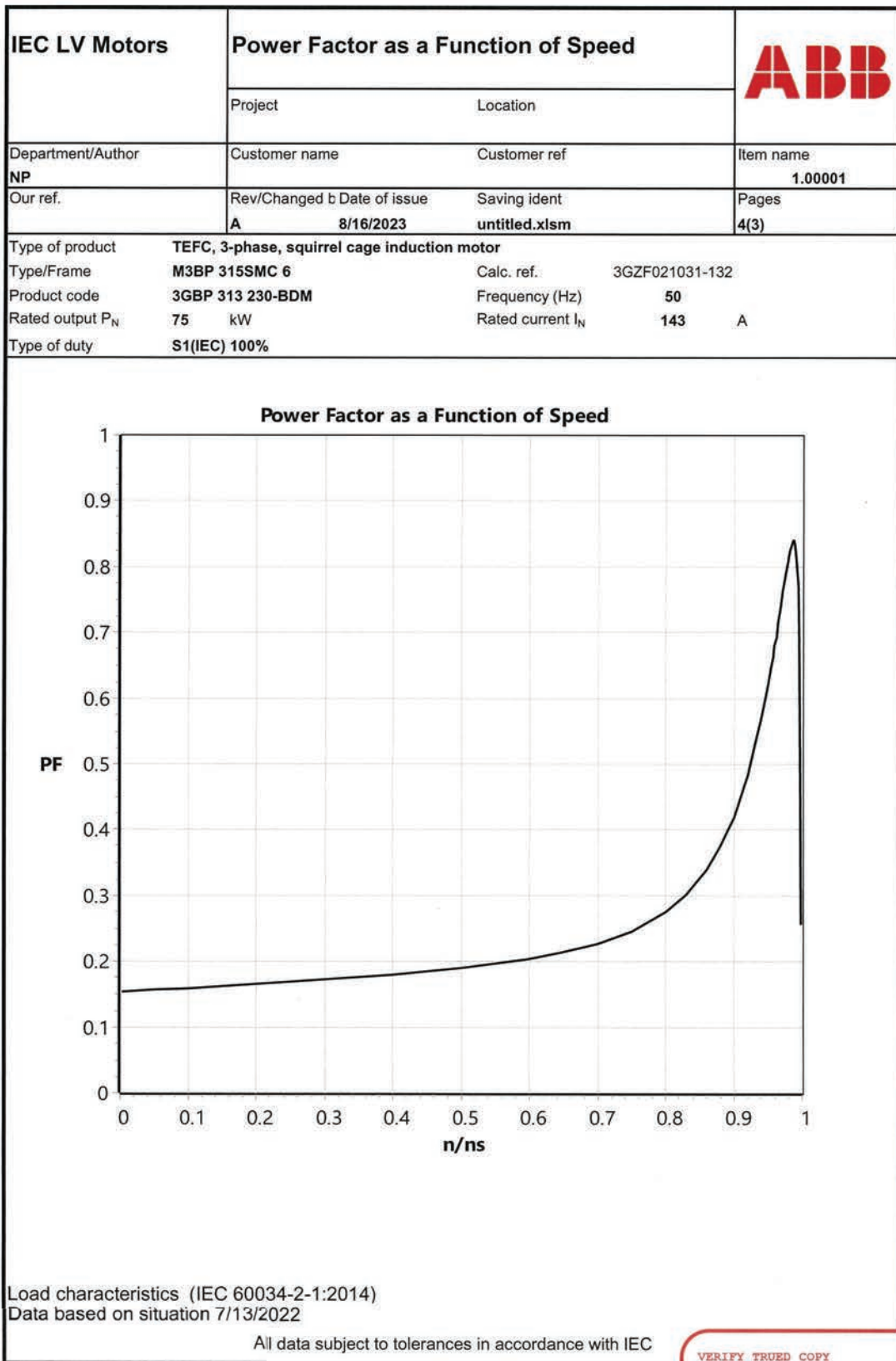


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IEC LV Motors		Thermal Withstand Curve		ABB	
		Project		Location	
Department/Author NP		Customer name		Customer ref	
Our ref.		Rev/Changed b Date of issue A 8/16/2023		Saving ident untitled.xlsm	
				Item name 1.00001	
				Pages 5(3)	
Type of product TEFC, 3-phase, squirrel cage induction motor					
Type/Frame		M3BP 315SMC 6		Calc. ref. 3GZF021031-132	
Product code		3GBP 313 230-BDM		Frequency (Hz) 50	
Rated output P_N		75 kW		Rated current I_N 143 A	
Type of duty S1(IEC) 100%					
J_{motor} (kgm ²) 4.9		Voltage (V) 100% 380		Voltage (V) 380V(100%)	
J_{load} (kgm ²)		T_{start}/T_N 2		T_{start}/T_N 2	
Speed (r/min) 993		Stall hot,cold(s) 0 / 0		Stall hot,cold(s) 0 / 0	
T_N (Nm) 721		Speed (r/min) 992		Speed (r/min) 980	
T_{load} (Nm) 721		I_s/I_N 6.3		I_s/I_N	
Nbr. of Consecutive Starts at UN		Hot: 55 Cold: 110		T_{max}/T_N 2.5	
				T_{max}/T_N	

Load characteristics (IEC 60034-2-1:2014)
Data based on situation 7/13/2022

All data subject to ances in accordance with IEC

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ว่าที่ ร.อ.ธรรมนัฐ แก้วบุญส่ง
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โทร. ๐๘๑-๔๔๔-๔๖๖๗



ข้อที่ 13.17, 33.2

IEC LV Motors	Start cold and warm(hot) with Temperature Caculation		ABB
	Project	Location	
Department/Author NP	Customer name	Customer ref	Item name 1.00001
Our ref.	Rev/Changed b Date of issue A 8/16/2023	Saving ident untitled.xlsm	Pages 5(3)
Type of product	TEFC, 3-phase, squirrel cage induction motor		
Type/Frame	M3BP 315SMC 6	Calc. ref.	3GZF021031-132
Product code	3GBP 313 230-BDM	Frequency (Hz)	50
Rated output P _N	75 kW	Rated current I _N	143 A
Type of duty	S1(IEC) 100%		

U/Un = 100%
 Time Start. = 0.4 Sec.
 Is/In = 6.3
 Load Type : Pump
 Calculation Number of Consecutive Starts at UN = Stall Time[s] at Is/In (Starting current) / Time Start [Sec.]
 So, Plot from graph below, the calculation will be

Hot = 22/0.4 = 55 Cold = 44/0.4 = 110

— Running Hot — Running Cold

Load characteristics (IEC 60034-2-1:2014)
 Data based on situation 7/13/2022
 All data subject to ances in accordance with IEC

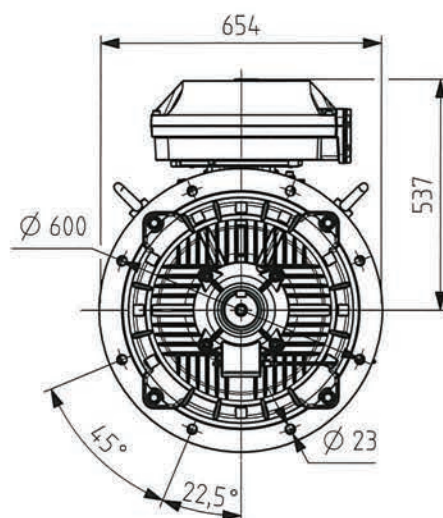
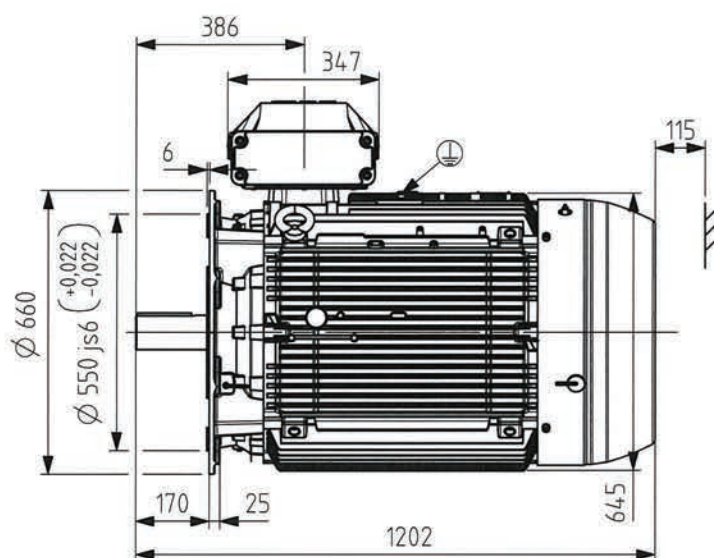
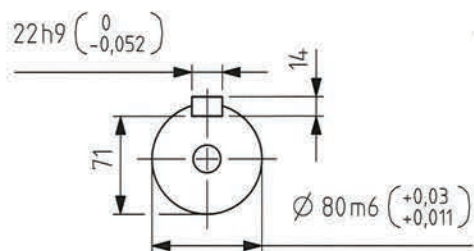
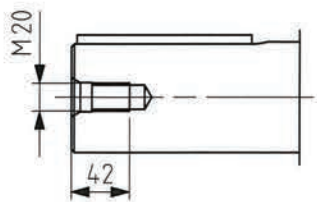
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 วิศวกรเครื่องกล สก.๒๙๗๐
 โทร. ๐๘๑-๔๔๔-๔๖๖๗



ข้อที่ 33.2



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โทร. ๐๘๑-๔๔๔-๔๖๖๗



Dimension Print

Motor type:
M3BP315 (G/K/L/M) SM_4-12; B5, V1, V3

Document No:
3GZF500031-3622 C

M3GPH315 (G/K/L/M) SM_4-12; B5, V3

Description:

STANDARD SQUIRREL CAGE MOTOR WITH TERMINAL BOX 370

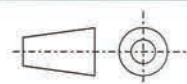
Unit: Motors and Generators
Date: 24-Jun-2019

Issued by: Penjala, likka
Approved by: Härmänmaa, Arttu

Replaces:
Replaced by:

ABB

Customer Reference:



Green Technology Asia CO., LTD.

80/28 Moo 2 Tiwanon 48 Rd., T.Thasai A.Muang,
Nonthaburi 11000, Thailand
TEL 0-2580-8339 FAX 0-2952-3397



บริษัท กรีน เทคโนโลยี เอเชีย จำกัด

80/28 หมู่ที่ 2 ถนนติวานนท์ 48 ตำบลท่าทราย
อำเภอเมือง จังหวัดนนทบุรี 11000
โทร. 0-2580-8339 แฟกซ์ 0-2952-3397

Instruction Manual For Pumps

	TECHNICAL INSTRUCTIONS	MANUAL NO. QBR8E01965S DATE 07/2022
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VERTICAL PUMPS

**RID_BANG BAN_PHRA NAKHON SI AYUTTHAYA PROVINCE VERTICAL
AXIAL-FLOW PUMPS--(ATURIA BRAND)**

INSTRUCTION MANUAL



Gruppo Aturia S.p.A.

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www.gruppoaturia.com

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ILLUSTRATIVE SECTION

PARTS LIST

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DELIVERY LETTER

1 PREFACE.

The purpose of this instruction manual is to facilitate the installation, use and maintenance of the **PEN series pumps**.

It is very important to read this manual in its entirety before installing and starting the pump in order to ensure the correct operation of the pump and the maximum safety of the personnel involved in its installation, start-up and maintenance.

Pleasenote that **PEN**pumps are potentially dangerous to people and property due to the following causes:



- High-speed rotating bodies

- High pressures



- Live parts

ATTENTION!

FAILURE TO COMPLY WITH THE INSTRUCTIONS IN THIS MANUAL OR IMPROPER USE OF THE EQUIPMENT BY UNQUALIFIED AND UNAUTHORISED PERSONNEL MAY CAUSE RISKS CAUSED BY PRESSURISED FLUIDS.

THE AFTER-SALES TECHNICAL SERVICE IS AT YOUR COMPLETE DISPOSAL : FOR ANY DOUBT OR PROBLEM, YOU CAN ALSO CONTACT US BY TELEPHONE:

2 DELIVERY NOTE VERIFICATION

Upon receipt of the material, it is necessary to inspect it and check it according to the delivery note. It is advisable to check the electric pump and accessories for any missing or damaged parts during transport.

3 WARRANTY

The warranty does not cover damage caused by incorrect manoeuvre or an error during assembly or connection.

In all cases, the warranty does not include compensation for greater damage for any reason.

We accept no liability for personal injuries or material damage caused by improper use of our devices.

The consumables are not covered by warranty.

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CHAPTER 1

DESCRIPTION

1.1 Construction features

The pump consists of (see attached sectional drawing).

- pump body, in two pieces (the suction bell (1223) and the rectifier(1170)) coupled by means of flanges tightened by bolts.
At the centre of the rectifier is a hub joined to the body by radial fins directing the liquid flow. Hub contains pump shaft support (2445.1)
- delivery support (1371), fitted with 3 flanges, the first for connection to the axis line pipe (1350) connecting to the pump body, the second for connection to the motor bellhousing (3160), and the third for connection to the delivery line. The dispensing support (1371) is equipped with the plate for support and anchoring to the support slab.
- gland seal (4130), to prevent leakage of liquid through the shaft passage. This consists of a cylindrical body fixed to the top of the delivery elbow, which has a seat to hold the seals. Compression of the gaskets is ensured by a pre-pressure plate(4120) with a flange through whose holes the studs (6572.2) fixed in the body pass. The degree of compression is set by tightening the nuts (3712.4) on the studs
- axle line pipes (1350), in variable quantities and shapes (cylindrical or truncated cone) depending on the technical specifications of each application. A shaft support (bushing 2187) may or may not be present in the shaft line pipes , **depending on** the overall length of the pump.
- pump shaft (2120), which is connected with key couplings on one side to the impeller and on the other side to the motor coupling. **Depending on** the length of the pump, the shaft (2120) can be divided into two or more sections connected by suitable sleeve couplings (7021).
- if fitted, a shaft protection tube (3741.1 - 3741.2), which is fitted when the bearings are lubricated with grease or clean water pumped from an external circuit, if the pumped liquid could damage the bearings. This tube runs from the hub in the rectifier to the supports in the intermediate trunks and the stuffing box body.
In the case of forced water lubrication from an external system, the protection pipe is provided with an inlet connection for the injection of lubrication water and an outlet connection for the recirculation of the lubrication water (alternatively, if the lubrication water is not recirculated, there is only a hole in the upper portion of the pipe for the discharge of the water, which then ends up in the tank from which it is pumped). In the case of grease lubrication, the grease is brought to each bearing by its own supply pipe from the grease pump, which can be either manual or motorised, with a timer if required to set the intervals between pumping and the duration of each pumping. The fat input is disposable.
- shaft supports (2187), consisting of a bearing inserted into a housing in the hub of the rectifier (1170) and shaft line tubes (1350). The bearing is made of special rubber in the case of water lubrication or bronze in the case of grease lubrication.
- motor bellhousing (3160) consisting of a cylindrical body with two flanges, one for connection to the presser curve and the other for motor connection.
- electric motor
- elastic joint
- impeller, consisting of blades (2200), hub (6440) and cover (1130.1)

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1.2 Field of application

The **PEN** pumps are mainly used in the following application fields:

- water plants;
- irrigation and drainage systems;
- industrial services;

The service, performance and application limits are described in the technical specification attached to the order confirmation.

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CHAPTER 2

TRANSPORT AND STORAGE

2.1 Transport

Before transport, carry out the following inspections:



- Electric pump unit weight.
- maximum overall dimensions of the unit
- hoisting points.

The pump can be packed for transport in the following ways:

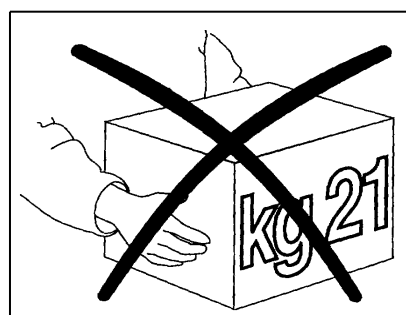
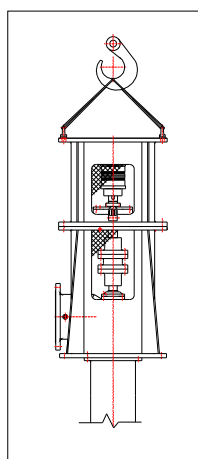
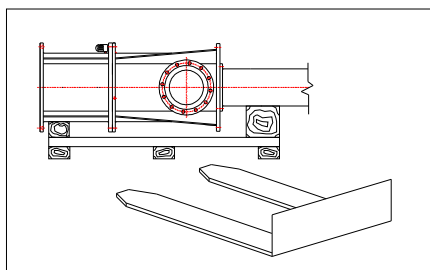
A on single pallet

B in wooden case

ATTENTION!

The pump must be transported using equipment suitable for its weight and the shape of the package.

Manual lifting is only permitted for weights under 20 Kg.



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2.2 Installation



During commissioning and maintenance work, all components must be transported safely in harnesses operated by trained personnel in order to avoid damaging the pump and injuring personnel.

If lifting rings are used for the various components, they should only be used to lift the components for which they have been supplied.

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2.3 Storage

BEFORE INSTALLATION FOR A SHORT PERIOD UP TO 3 MONTHS

place the pump in a covered place that is not damp

prevent the ambient temperature from dropping below 5°C

rotate the rotating part at regular intervals every 15 days by acting on the coupling to the motor.

BEFORE INSTALLATION AND FOR A LONG PERIOD MORE THAN 3-4 MONTHS :

-lift the pump off the ground using wooden supports.

-Open any packaging, remove the port covers and clean with compressed air, drying the inside of the pump thoroughly if necessary.

-insert any anti-condensation products, then restore the outlet protections.

-completely protect the pump with tarpaulins or PVC foil, possibly including anti-condensation products.

-periodically check the condition of the protections.

-rotate the rotating part at regular intervals every 30 days by acting on the coupling to the motor.

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CHAPTER 3

GENERAL SAFETY REGULATIONS

3.1 General requirements



The pumps must only be used for the uses and within the limits described in par.1.2.

For pump uses not specified in this user manual, please contact ATURIA to confirm the suitability for use, the safety of the system and the duration of the pump.

3.2 Precautions during regular operation

The safety precautions to be observed are:



-the joint protection must be in place

- protect the motor and electrical parts according to current regulations.

-take great care not to put hands, tools or other objects into the openings of the bearings near the rotating shaft.



-the protections of the motor and the electrical parts must be activated.

HOWEVER, THE PUMP MUST BE INSTALLED IN A SAFE AREA.

3.3 Residual risks

Failure to observe the safety instructions in this manual may result in dangerous situations and hazardous events for persons and property.

Do not subject the pump to:



-impacts

-manoeuvre error with moving equipment or blunt objects in the vicinity of the pump

-abnormal overpressures

-dry running, flow rate below the minimum permitted or with a gate valve of supply completely closed

-improper use with harmful or dangerous liquids and in any case different from what is declared in the order specification

3.4 In the event of a breakdown

-Disconnect line voltage

-Notify the personnel responsible for the installation

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CHAPTER 4

INSTALLATION

4.1 Installation

Installation must be carried out in such a way as to respect the perfect verticality of the shaft; intervene on the adjusting screws if present, or in their absence, with suitable steel shims.

The pump is intended for immersed operation or for an installation containing the liquid to be pumped.

It is important to ensure that the variations in the level of the liquid to be pumped are well defined so that the minimum level is such that the pump can function properly.

After installation and before starting the pump, make sure that the rotating part rotates freely; it must be possible to turn by hand by acting on the coupling.

If this is not the case, revise the coupling and installation as indicated in the installation instructions.

This check must be made at the first start-up and after every long period of standstill.

When starting for the first time, check the direction of rotation of the electric motor by applying voltage for a moment.

The pump should turn clockwise when viewed from above.

The pressure pipe must be connected in such a way as to avoid creating excessive radial forces on the bearing which could cause rapid deterioration of the guide bearings.

ATTENTION!

IT IS IMPORTANT TO AVOID EXCESSIVE LOADS ON THE FLANGES DUE TO PIPING. ANY RESIDUAL LOADS MUST NOT EXCEED THE LIMITS SET OUT IN THE TECHNICAL DOCUMENTS ACCOMPANYING THE PUMP.

BEFORE TIGHTENING THE FOUNDATION BOLTS, CHECK THAT THE CONCRETE HAS SET .

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4.2 Electrical connection



Electrical connections must only be made by specialised personnel; strictly follow the instructions of the motor and electrical equipment manufacturer.

In the case of three-phase current, always ensure that the voltage of the three phases is the same. Correctly connect the motor's earthing.



Remove the terminal block cover by unscrewing the fixing screws; then make the connections as indicated inside the terminal block cover and replace the terminal block cover.

Once the electrical connections have been made, close the delivery gate valve and check the correct direction of rotation.

Run the pump for a short time, if it rotates in the opposite direction swap two of the three power cables.

Under no circumstances must the current absorbed by the motor exceed the current indicated on the nameplate; if this occurs, adjustment must be made by reducing the flow rate, and therefore the load, by partially closing the control gate.

NOTE:

It is advisable to install a protector upstream of the motor to protect it from excessive voltage drops and overloads. For its correct sizing, follow the current values indicated on the motor nameplate.

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CHAPTER 5

COMMISSIONING AND START-UP

5.1 Start-up

ATTENTION!

Check at first start-up:

- the direction of rotation of the motor with the pump disconnected; if this is not correct, if the power supply is three-phase, reverse the connection of two phases
- the level of the liquid to be pumped, which must not be lower than indicated in the pump's technical specification.

Ensure that the mobile unit turns freely by hand, without any friction points, by operating it from the coupling.

Start the engine by checking the direction of rotation.

Gradually open the discharge gate until the pressure reaches the value specified in the contract and check that the current value at the control panel does not exceed the motor's nameplate value.

It is good practice to protect the motor from excessive voltage drops and overloads.

If, during start-up, it is believed that the pump is operating abnormally, it is essential to stop it and look for the causes of the fault.

ATTENTION!

WARNING:

BEFORE STARTING THE PUMP, IT IS NECESSARY FOR THE SYSTEM TO BE CORRECTLY COMPLETED FROM AN ELECTRICAL AND MECHANICAL POINT OF VIEW.

DO NOT START THE PUMP WITHOUT COUPLING PROTECTION!

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CHAPTER 6

MAINTENANCE

6.1 Ordinary maintenance

Once you have verified smooth operation of the pump using the system equipment, it does not normally require maintenance except for periodical inspections of:

- the smooth operation of the bearings
- periodic oil change in the bearing housing

6.2 Lubrication of the shaft bearings

There are three lubrication options:

With the same liquid pumped

When the pumped liquid is clean, there is no danger of pollution or poor lubrication of the bearings; it penetrates into the bearings and lubricates them. In this case the pump is without the shaft protection tube (3741.1 - 3741.2).

With water from an external source

This is pressurised into the protective tube (3741.1 - 3741.2) of the brackets through a special connection in the lower area near the impeller. Water flows up the pipe and is either discharged through a hole at the top or is recovered and recycled through an outlet fitting in the pipe.
It is the operators' responsibility to ensure the constant flow of lubrication water.

With grease

A hand or electric pump feeds a distributor from which many feed tubes reach each holder.

In the case of a manual pump, it is the operator who pumps a certain number of strokes at set intervals to introduce fresh grease into the bearings.

In the case of an electric pump, there is usually a timer that sets the frequency and duration of pumping. The operator is responsible for keeping a supply of grease in the pump tank at all times.

A pressure gauge on the pump outlet helps to check whether lubrication is taking place smoothly. On the inlet of each line in the bracket there is a check valve which opens when the pressure is about 3 bar, so when the pump starts up the pressure gauge should be set to about 4-5 bar. If the pressure is higher, there is an obstruction preventing the flow of fat. If, on the other hand, the pressure drops below 3 bar, it means that there is a break in the tube or a leak in a fitting and the grease does not reach the bearing.

ATTENTION!

NEVER RUN THE PUMP DRY (WITH AN EMPTY TANK) AS FAILURE TO LUBRICATE A FLAT BEARING WILL CAUSE ITS TEMPERATURE TO RISE RAPIDLY, RESULTING IN BURNS AND IRREVERSIBLE DAMAGE.

6.3 Thrust bearing lubrication

There are two types of mounts, the first for power ratings below 250 hp and the second for power ratings of 250 hp and above (see section 7.1).

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Thrust ball and roller bearings (**3011** and **3014**) are oil lubricated.

The oil level can be checked by means of the constant level sight glass (**8221**) or the oiler(**3855**) mounted on the bearing housing (**3242**).

The oil-lubricated bearing used can operate at a temperature of 50°C above the ambient temperature with a maximum of 80°C in absolute terms.

For lubrication, we recommend the use of solvent-refined mineral oils with high chemical stability and resistance to oxidation, rust-proofing properties, high anti-foaming and demulsibility, and high resistance to the formation of sludge and oxidation deposits.

The oil used must have a kinematic viscosity measured at 40°C corresponding to ISO VG 68.

This oil has a kinematic viscosity, at the operating temperature of the bearing, which ensures the formation of a lubricant film of sufficient thickness in the contact areas between the raceways and rolling elements.

If the bearing temperature does not exceed 50°C and there is no pollution of the oil by foreign substances, it is sufficient to renew the oil once a year.

Higher operating temperatures or more severe operating conditions require more frequent oil changes, with a bearing temperature of 100°C the oil should be renewed every three months (lubrication intervals also include periods when the pump is not running).

If the pump is not used for a long period of time (6 months or more), it is advisable to completely renew the oil in the bearing.

The oil is filled in by removing the plug (**3854**) at the top of the bearing box, and discharged by removing the plug (**6515.1**) on the flange of the box, approximately under the socket.

ATTENTION!

THE BEARING HOUSING (**3242**) IS ALWAYS DELIVERED EMPTY (WITHOUT LUBRICATION OIL).

THEREFORE, WHEN THE PUMP IS INSTALLED ON THE SYSTEM, ALWAYS REMEMBER TO FILL THE BEARING HOUSING WITH THE REQUIRED OIL.

6.3 Repair

Before intervening on the machine, it is essential to:

- disconnect voltage.
- close the pump discharge gate valve;
- if the machine carries hot liquids, let it cool down to room temperature

6.4 Pump stop

Perform the following operations in this order:

- Cut the power to the motor
- Close the gate valve on the pressure pipe

6.5 Operation

Operation must take place without abnormal vibrations.

Monitor the pressure and the value of the current drawn by the motor during the pumping operation.

Check the temperature of the ball bearings, which must not exceed 50°C above the ambient temperature.

The pump must not operate at a higher flow rate than that for which it was sold, in order to avoid a reduction in the NPSH available at suction.

CHAPTER 7

DISASSEMBLING

These machines are processed with great care and should only be disassembled and reassembled by qualified personnel.

For all movements of the machine and its parts, follow the instructions in section 2.



Operate carefully and without blows, applying tally marks to the parts during disassembly.

7.1 Thrust bearing inspection

Type 1 bracket (for power ratings below 250 hp)

Remove the screws that secure the motor coupling spacer (**7010**).

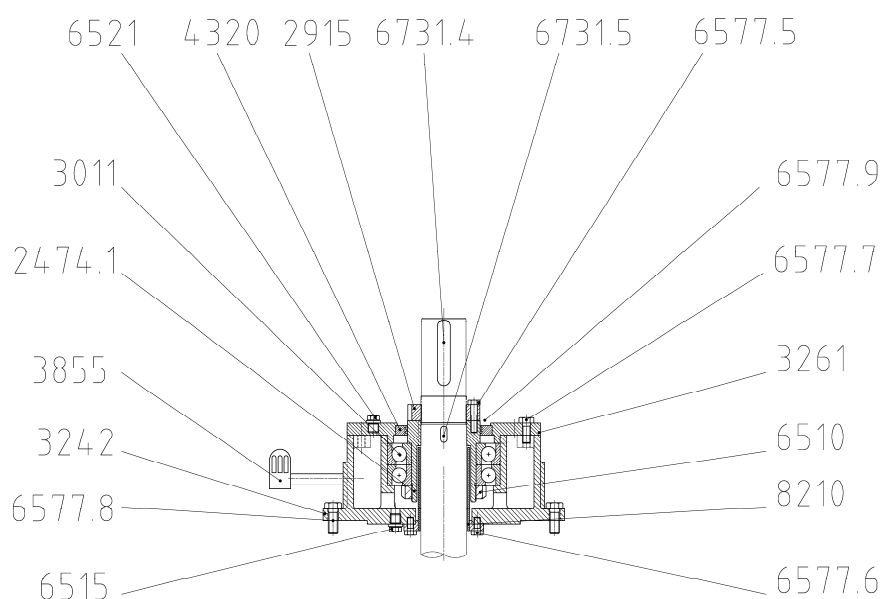
Removing the motor

Remove the lower half of the coupling.

Remove the screw (**6577.5**) securing the adjustment ring nut (**2915**) then unscrew the ring nut from the drive shaft.

After removing the bearing cover (**3261**), remove the bearing bush (**2474.1**) complete with bearing (**3011**) and locking ring (**6510**).

The bearing housing (**3242**) is removed from the shaft after removing the key (**6731.4**), the oiler (**3855**) and the fixing screws (**6577.8**).



Type 2 bracket (for power ratings from 250 hp upwards)

Remove the screws that secure the motor coupling spacer (**7010**).

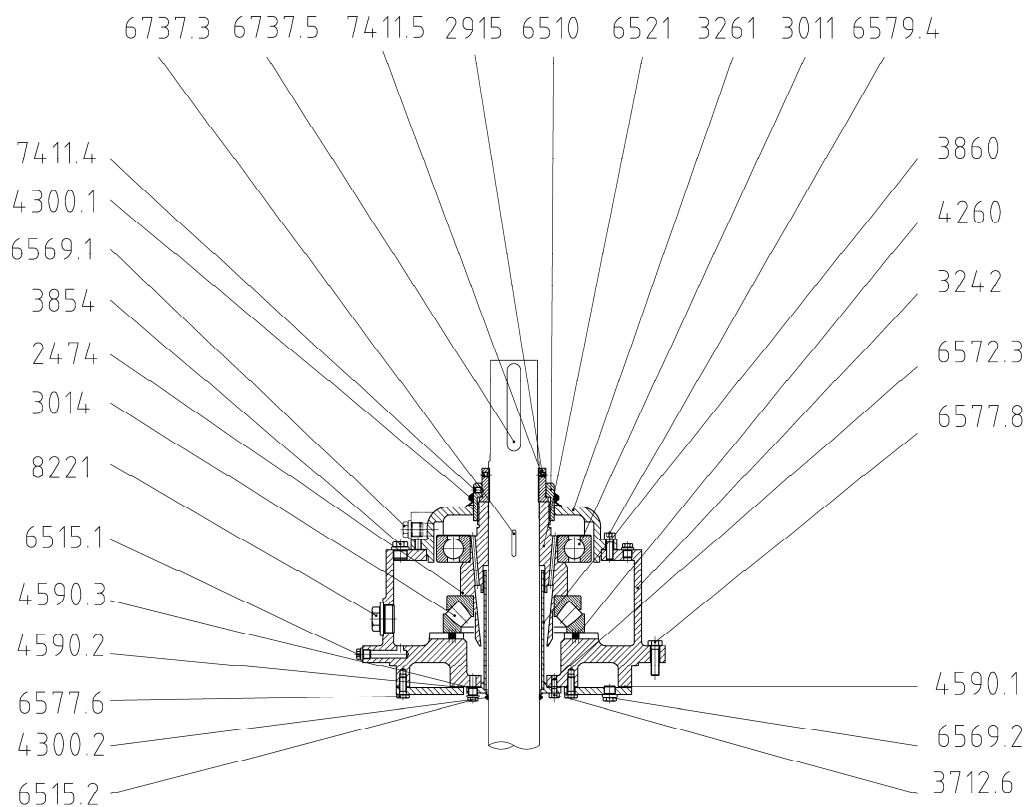
Removing the motor

Remove the lower half of the coupling.

Remove the dowels (**7411.4** and **7411.5**) that secure the adjustment ring nut(**6510**) and the nut (**2915**), then unscrew the ring nut from the drive shaft.

After removing the bearing cover (**3261**), remove the bearing bush (**6521**) complete with bearings (**3011** and **3014**).

The bearing housing (**3242**) is removed from the shaft after removing the key (**6737.5**) and fixing screws (**6577.8**).



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7.3 Removing the pump from the tank and dismantling it

The following description is valid for disassembling the pump without removing it from the tank. **In the case** of fairly short pumps, it is possible to remove the whole pump and proceed in a similar manner in a simpler way, e.g. by accessing the impeller assembly (2200,6440) without necessarily having to remove all upper parts.

Disconnect the pressure line.

Disconnect accessory pipes.

Remove motor and lantern (3160), bearing box (3242) and packing box (4110).

After removing the nuts of the foundation bolts that secure the delivery support to the laying surface, lift the unit so that the flange of the axle tube (1350) protrudes from the laying surface.

Place a bracket between the pipe (1350) and the laying surface.

Unscrew the bolts connecting the axle tube flanges (1350) to the delivery support (1371) and once disconnected, lift the delivery support (1371) off the shaft (2120).

Repeat the above operations until you reach the pump body.

Supporting the shaft (2120), loosen the screws (7411.2) of the sleeve coupling (7021) and slide it upwards until the two-piece ring (7415.1) holding the shafts together is uncovered and removed; **when the shafts are** separated, remove the shaft (2120) thus released and proceed in the same way to the last section of the transmission column.

Raise the pump completely and proceed to dismantle it on the table in order to make the operation easier.

Undo the screws (6577.1) and remove the suction body (1223). Undo the screws (6579.1) and remove the cover (1130.1). Unscrew the screws (6577.5), remove the cover (1130.2) and the ring (7415.2). Then remove the impeller assembly (2200,6440).

CHAPTER 8

REMOVAL

Before carrying out this operation, it is necessary to check the condition of the parts subject to wear, in particular the sealing rings (**1500**). In the event of excessive wear, they should be replaced.

Reassemble the pump by carrying out the operations described in the previous paragraph in reverse order.

ADJUSTMENT OF IMPELLER POSITION

Completely unscrew the adjustment ring nut (**2915**) and measure the distance "H".

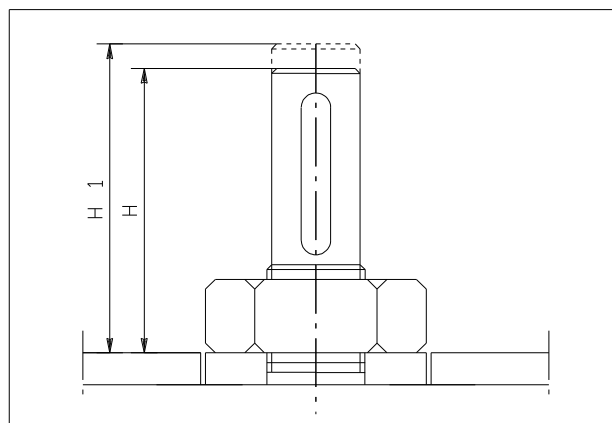
Tighten the adjustment ring nut (**2915**) without force to raise the rotor as far as possible.

Measure distance "H1"

Unscrew the adjustment ring nut (**2915**) until the rotor is lowered by half the axial clearance resulting from the two previous measurements $H1 - H$.

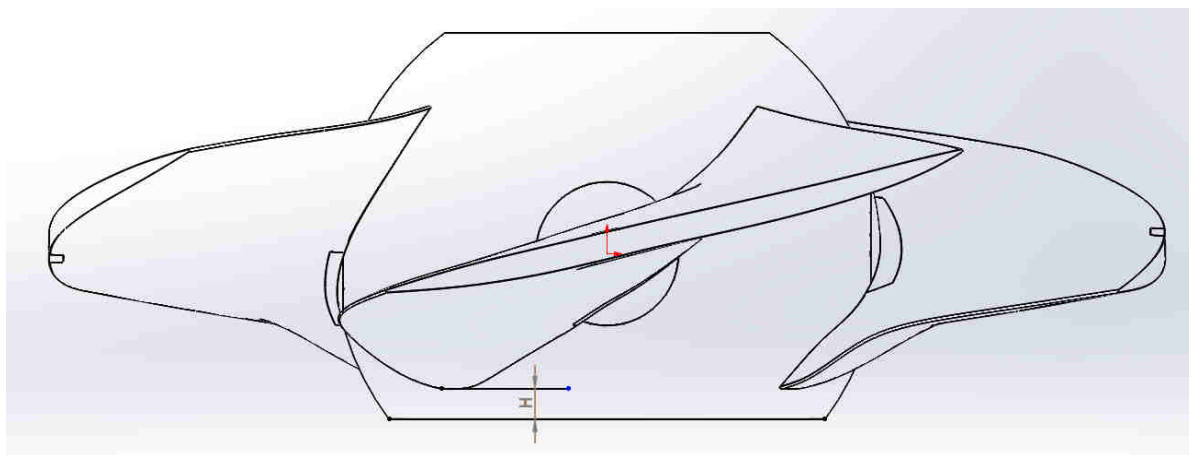
Lock the ring nut with the set screw (**6570**).

Mount the key (**6737.5**) and the lower coupling half on the shaft.



ADJUSTMENT OF BLADE INCLINATION

If necessary, the inclination of the blades can be varied by acting on the blade locking nuts and rotating the blades with the reference notch on the body (6440), corresponding to the zero position. Turning the blades clockwise decreases the angle of inclination and vice versa. To adjust the blades to the same angle, measure the distance H shown in the figure.



CHAPTER 9

BADERNA ESTATE

9.1 - DISASSEMBLING

Unscrew the studs holding the muffler and lift it off.

Using a flexible helical spanner (see figure) or similar tool, remove all packing rings and clean the surface of the under-shell bushing and the spacer ring (if present).

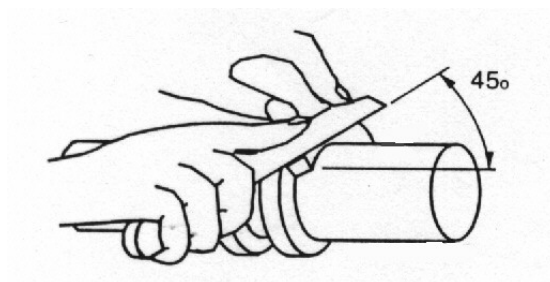
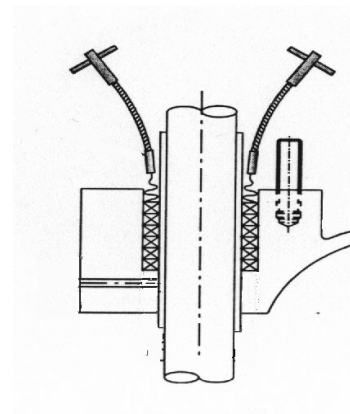
9.2 - DISASSEMBLING

Before fitting the new packing, visually check the surface of the sleeve under the packing: if it shows signs of wear, it must be replaced.

The packing rings to be used vary in size according to the type of cylinder head used. Pre-formed rings or strips may be used; in this case, it is advisable, before cutting the rings, to wind them onto a cylinder of the same diameter as the shaft, taking care to leave a clearance of about 2mm.

The braid must be cut at an angle (see figure).

The packing rings must be mounted in the housing with the slots offset.





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CHAPTER 10

MALFUNCTION: CAUSES AND REMEDIES

EFFECT	POSSIBLE CAUSE	SOLUTION
VIBRATIONS AND NOISE	The pump runs in the opposite direction	See par. 5.1
	The backing plate is not firmly anchored	Review installation
	The minimum head of pumped liquid is not sufficient	Review installation
	Flat or ball bearings are out of use	Repair
	The pump works very much to the right or left of the contract point	Return to the correct working point
IRREGULAR ELECTRICAL OPERATION	The engine does not start or does not bear the load:	Ensure that the mains voltage is as indicated on the motor nameplate.
		Check that the contactor disconnectors are in good condition.
		Check that the connection to the motor terminals is correct and appropriate for the available voltage.
SCOPE INSUFFICIENT		Check the direction of rotation
	The pump does not run at the required speed	Check the system and installation
	Gate valves or other unopened elements in pipe circuits	Remove the causes.
	Manometric pressure at discharge too high.	Return to the correct working point
	Pump body and/or impeller wear.	Repair see chap. 8

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CHAPTER 11

DECOMMISSIONING AND DEMOLITION

11.1 Decommissioning and demolition

When decommissioning the pump and demolishing it, we recommend proceeding with the separate disposal of the materials.



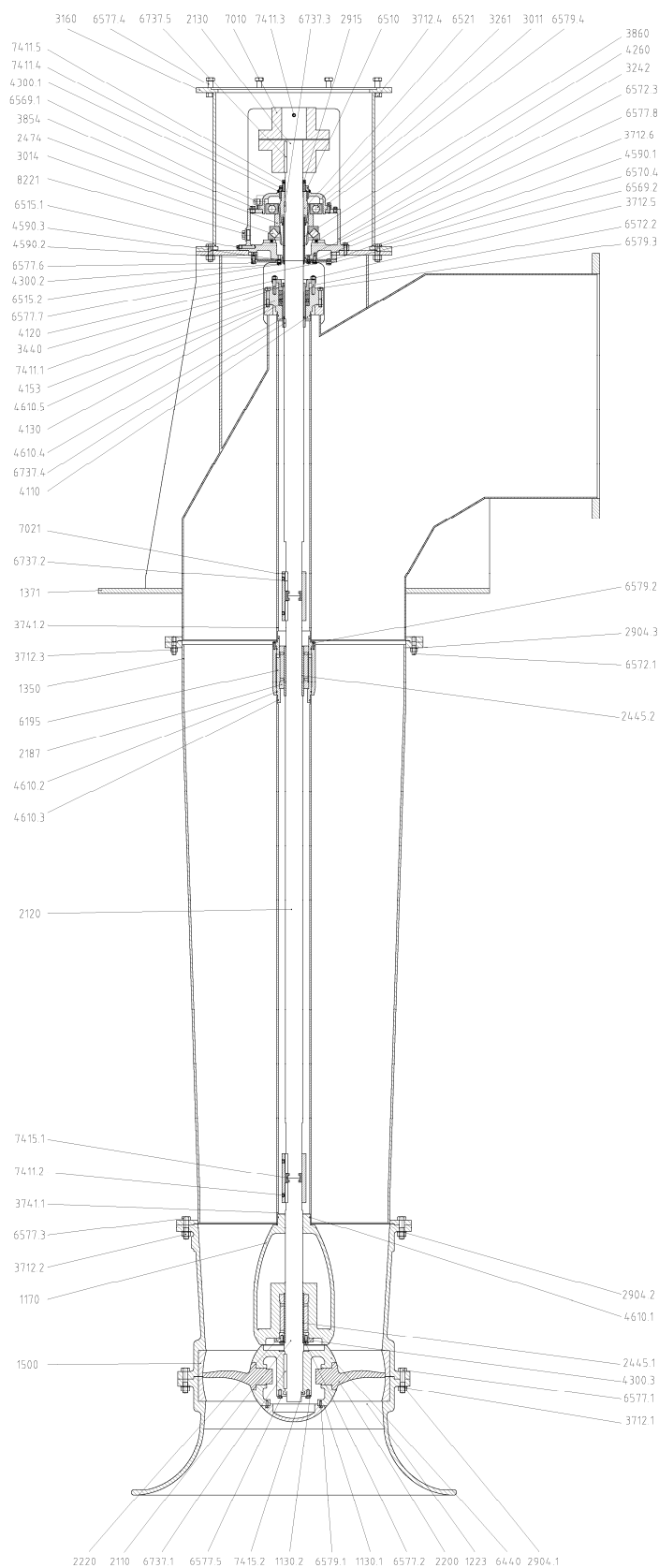
There must be no residues of polluting liquids inside the pump.
harmful or dangerous.

The discharge and disposal of liquids that are harmful to health must be carried out in such a way that they do not pose a danger to people, and the specific legal regulations must be observed.

The materials used are:

- steel, cast iron
- aluminium
- plastic rubber material
- copper, brass, bronze

Polluting liquids and materials must be disposed of in accordance with the specific regulations in force.





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Pos.	Name	Pos.	Name
1130.1	Cover	4610.1	O-Ring
1130.2	Cover	4610.2	O-Ring
1170	Pump body	4610.3	O-Ring
1223	Suction bell	4610.4	O-Ring
1350	Pipe Axis line	4610.5	O-Ring
1371	Support Delivery	6195	Bushing Holder
1500	Impeller Shave Ring	6440	Impeller hub
2110	Pump shaft	6510	Ferrule
2120	Shaft Axis line	6515.1	Drain plug
2130	Drive Shaft	6515.2	Drain plug
2187	Bushing Bush	6521	Breather cap
2200	Pala Girante	6569.1	Cap
2220	Stop Domsel	6569.2	Cap
2245.1	Shirt Tree Protection	6577.1	Screw
2245.2	Shirt Tree Protection	6577.2	Screw
2474	Bush Centring Bearing	6577.3	Screw
2904.1	Washer	6577.4	Screw
2904.2	Washer	6577.5	Screw
2904.3	Washer	6577.6	Screw
2915	Adjusting nut	6577.7	Screw
3011	Radial ball bearing	6577.8	Screw
3014	Roller thrust bearing	6579.1	Screw
3160	Motor Lantern	6579.2	Screw
3242	Thrust and guide bearing housing	6579.3	Screw
3261	Supporter cover	6579.4	Screw
3440	Premitreccia shirt	6572.1	Prisoner
3712.1	Dado	6572.2	Prisoner
3712.2	Dado	6572.3	Prisoner
3712.3	Dado	6731.1	Feather key
3712.4	Dado	6731.2	Feather key
3712.5	Dado	6731.3	Feather key
3712.6	Dado	6731.4	Feather key
3741.1	Axis Line Protection Tube	6731.5	Feather key
3741.2	Axis Line Protection Tube	6731.6	Feather key
3854	Oil filler cap	6731.7	Feather key
3860	Oil level glass	6731.8	Feather key
4110	Orifice box	6731.9	Feather key
4120	Premitreccia	7010	Joint
4130	Baderna	7021	Coupling Sleeve
4153	Premitreccia lantern	7411.1	Grano
4260	Spring	7411.2	Grano
4300.1	Lip seal. radial	7411.3	Grano
4300.2	Lip seal. radial	7411.4	Grano
4300.3	Domsel gasket	7415.1	Ring in 2 halves
4590.1	Flat gasket	7415.2	Ring in 2 halves
4590.2	Flat gasket	8221	Oil level sight glass
4590.3	Flat gasket		



TECHNICAL INSTRUCTIONS

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DECLARATION OF INCORPORATION

(according to annex II A - Machinery Directive 98/37/EC)

DECLARATION OF INCORPORATION

(according to enclosure II B - Machinery Directive 98/37/EC)

Section 1

Section 1

MACHINE DESCRIPTION

Machinery Description

Manufacturer
Manufacturer

GRUPPO ATURIA S.P.A.

Type

PEN

Model

ELV-500S

Description
Description

Vertical axial pump
Axial vertical pump

Section 2

Section 2

APPLICABLE STANDARDS / DIRECTIVES

Applicable Directives / Standards

Machinery Directive 98/37/CE

Machinery Directive 98/37/EC

Section 3

Section 3

APPLICABLE SPECIFICATIONS AND STANDARDS

Applicable standards / Specifications

European Standard EN 809 - EN 292

European Standard EN 809 – 292

Section 4

Section 4

DECLARATION

Declaration

We, Gruppo Aturia S.p.a./Piazza Aturia,9/Gessate/Mi/, declare under our own responsibility that for the supplies of machinery and/or components defined in Section 1, we guarantee compliance with the Standards and Directives referred to in Section 2, 3 for the essential requirements of safety and health protection.

Warning :

It is expressly forbidden to put into service before the machine, in which it will be incorporated, has been declared to comply with the provisions of the Directive.

We, Gruppo Aturia S.p.a. /Piazza Aturia,9/Gessate/ Mi/, declare that under our sole responsibility for the supply of machinery and components defined in Section 1 above, the said machinery complies with the applicable Directives and Standards set out in Section 2 , 3 above and with the essential health and safety requirements applying to it.

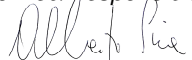
Warning :

The machinery must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the Directive.

RESPONSIBLE

Authorized/Responsible Officer

Signature
Signed



date: 07/2019

Qualification
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โทร. 0-2580-8339 แฟกซ์ 0-2952-3397

Instruction Manual For Motors

Low voltage motors

Installation, operation, maintenance and safety manual



Installation, operation, maintenance and safety manual EN 3

More languages – see web site www.abb.com/motors&generators > Motors > Document library

Low voltage motors

Installation, operation, maintenance and safety manual

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1. Introduction

NOTE!

These instructions must be followed to ensure safe and proper installation, operation and maintenance of the motor. They should be brought to the attention of anyone who installs, operates or maintains the motor or associated equipment. The motor is intended for installation and use by qualified personnel, familiar with health and safety requirements and national legislation. Ignoring these instructions may invalidate all applicable warranties.

1.1 Declaration of Conformity

The conformity of the end product according to Directive 2006/42/EC (Machinery) has to be established by the commissioning party when the motor is fitted to the machinery.

1.2 Validity

These instructions are valid for the following ABB electrical machine types, in both motor and generator operation:

series MT*, MXMA,
series M1A*, M2A*/M3A*, M2B*/M3B*, M4B*, M2C*/M3C*,
M2F*/M3F*, M2L*/M3L*, M2M*/M3M*, M2Q*, M2R*/M3R*,
M2V*/M3V*
in frame sizes 56 - 450.

There is a separate manual for e.g. Ex motors 'Low voltage motors for explosive atmospheres: Installation, operation and maintenance and safety manual (3GZF500730-47)

Additional information is required for some machine types due to special application and/or design considerations.

Additional manual is available for the following motors:

- roller table motors
- water cooled motors
- smoke extraction motors
- brake motors
- motors for high ambient temperatures
- motors in marine applications for mounting on open deck of ships or offshore units

2. Safety considerations

The motor is intended for installation and use by qualified personnel, familiar with health and safety requirements and national legislation.

Safety equipment necessary for the prevention of accidents at the installation and operating site must be provided in accordance with local regulations.

WARNING!

Emergency stop controls must be equipped with restart lockouts. After emergency stop a new start command can take effect only after the restart lockout has been intentionally reset.

Points to be observed:

1. Do not step on the motor.
2. The temperature of the outer casing of the motor may be hot to the touch during normal operation and especially after shut-down.
3. Some special motor applications may require additional instructions (e.g. when supplied by frequency converter).
4. Observe rotating parts of the motor.
5. Do not open terminal boxes while energized.

3. Handling

3.1 Reception

Immediately upon receipt, check the motor for external damage (e.g. shaft-ends, flanges and painted surfaces) and, if found, inform the forwarding agent without delay.

Check all rating plate data, especially voltage and winding connections (star or delta). The type of bearing is specified on the rating plate of all motors except the smallest frame sizes.

In the case of a variable speed drive application check the maximum loadability allowed according to frequency stamped on the motor's second rating plate.

3.2 Transportation and storage

The motor should always be stored indoors (above $-20\text{ }^{\circ}\text{C}$), in dry, vibration-free and dust-free conditions. During transportation, shocks, falls and humidity should be avoided. In other conditions, please contact ABB.

Unprotected machined surfaces (shaft-ends and flanges) should be treated against corrosion.

It is recommended that shafts are rotated periodically (once per quarter) by hand to prevent grease migration.

Anti-condensation heaters, if fitted, are recommended to be used to avoid water condensing in the motor.

The motor must not be subject to any external vibrations at standstill so as to avoid causing damage to the bearings.

Motors fitted with cylindrical-roller and/or angular contact bearings must be fitted with locking devices during transport.

3.3 Lifting

All ABB motors above 25 kg are equipped with lifting lugs or eyebolts.

Only the main lifting lugs or eyebolts of the motor should be used for lifting the motor. They must not be used to lift the motor when it is attached to other equipment.

Lifting lugs for auxiliaries (e.g. brakes, separate cooling fans) or terminal boxes must not be used for lifting the motor. Because of different output, mounting arrangements and auxiliary equipment, motors with the same frame may have a different center of gravity.

Damaged lifting lugs must not be used. Check that eyebolts or integrated lifting lugs are undamaged before lifting.

Lifting eyebolts must be tightened before lifting. If needed, the position of the eyebolt can be adjusted using suitable washers as spacers.

Ensure that proper lifting equipment is used and that the sizes of the hooks are suitable for the lifting lugs.

Care must be taken not to damage auxiliary equipment and cables connected to the motor.

Remove eventual transport jigs fixing the motor to the pallet.

Specific lifting instructions are available from ABB.

WARNING!

During lifting, mounting or maintenance work, all necessary safety considerations shall be in place and special attention to be taken that nobody will be subject to lifted load.

3.4 Motor weight

The total motor weight can vary within the same frame size (center height) depending on different output, mounting arrangement and auxiliaries.

The following table shows estimated maximum weights for machines in their basic versions as a function of frame material.

The actual weight of all ABB's motors, except the smallest frame sizes (56 and 63), is shown on the rating plate.

Frame size	Aluminum Weight kg	Cast iron Weight kg	Add. for brake
56	4.5	–	–
63	6	–	–
71	8	13	5
80	14	20	8
90	20	30	10
100	32	40	16
112	36	50	20
132	93	90	30
160	149	130	30
180	162	190	45
200	245	275	55
225	300	360	75
250	386	405	75
280	425	800	–
315	–	1700	–
355	–	2700	–
400	–	3500	–
450	–	4500	–

If the motor is equipped with a separate fan, contact ABB for the weight.

4. Installation and commissioning

WARNING!

Disconnect and lock out before working on the motor or the driven equipment.

4.1 General

All rating plate values must be carefully checked to ensure that the motor protection and connection will be properly done.

When starting the motor for the first time or after it has been in storage more than 6 months, apply the specified quantity of grease.

See section “7.2.2 Motors with re-greasable bearings” for more details.

When fitted in a vertical position with the shaft pointing downwards, the motor must have a protective cover to prevent foreign objects and fluid from falling into the ventilation openings. This task can also be achieved by a separate cover not fixed to the motor. In this case, the motor must have a warning label.

4.2 Motors with other than deep groove ball bearings

Remove transport locking if employed. Turn the shaft of the motor by hand to check free rotation, if possible.

Motors equipped with cylindrical roller bearings:

Running the motor with no radial force applied to the shaft may damage the roller bearing due to “sliding”,

Motors equipped with angular contact ball bearing:

Running the motor with no axial force applied in the right direction in relation to the shaft may damage the angular contact bearing.

WARNING!

For motors with angular contact bearings the axial force must not by any means change direction.

The type of bearing is specified on the rating plate.

4.3 Insulation resistance check

Measure insulation resistance (IR) before commissioning, after long periods of standstill or storage when winding dampness may be suspected. IR shall be measured directly on the motor terminals with the supply cables disconnected in order to avoid them affecting the result.

Insulation resistance should be used as a trend indicator to determine changes in the insulation system. In new machines the IR is usually thousands of Mohms and thus following the change of IR is important so as to know the condition of the insulation system. Typically, the IR should not be below 10 MΩ and in no case below 1 MΩ (measured with 500 or 1000 VDC and corrected to 25 °C). The insulation resistance value is halved for each 20 °C increase in temperature.

Figure 1, in chapter 11, can be used for the insulation correction to the desired temperature.

WARNING!

To avoid risk of electrical shock, the motor frame must be grounded and the windings should be discharged against the frame immediately after each measurement.

If the reference resistance value is not attained, the winding is too damp and must be oven dried. The oven temperature should be 90 °C for 12-16 hours followed by 105 °C for 6-8 hours.

If fitted drain hole plugs must be removed and closing valves must be opened during heating. After heating, make sure the plugs are refitted. Even if the drain plugs are fitted, it is recommended to disassemble the end shields and terminal box covers for the drying process.

Windings drenched in seawater normally need to be rewound.

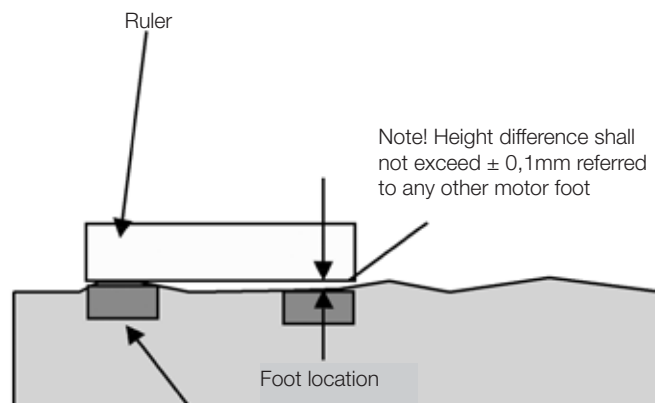
4.4 Foundation

The end user has full responsibility for preparation of the foundation.

Metal foundations should be painted to avoid corrosion.

Foundations must be even and sufficiently rigid to withstand possible short circuit forces.

They must be designed and dimensioned to avoid the transfer of vibration to the motor and vibration caused by resonance. See figure below.



4.5 Balancing and fitting coupling halves and pulleys

As standard, balancing of the motor has been carried out using half key.

Coupling halves or pulleys must be balanced after machining the keyways. Balancing must be done in accordance with the balancing method specified for the motor.

Coupling halves and pulleys must be fitted on the shaft by using suitable equipment and tools which do not damage the bearings and seals.

Never fit a coupling half or pulley by hammering or removing it by using a lever pressed against the body of the motor.

4.6 Mounting and alignment of the motor

Ensure that there is enough space for free airflow around the motor. It is recommended to have a clearance between the fan cover and the wall etc. of at least $\frac{1}{2}$ of the air intake of the fan cover. Additional information may be found from the product catalog or from the dimension drawings available on our web pages: www.abb.com/motors&generators.

Correct alignment is essential to avoid bearing, vibration and possible shaft failures.

Mount the motor on the foundation using the appropriate bolts or studs and place shim plates between the foundation and the feet.

Align the motor using appropriate methods.

If applicable, drill locating holes and fix the locating pins into position.

Mounting accuracy of coupling half: check that clearance b is less than 0.05 mm and that the difference a1 to a2 is also less than 0.05 mm. See figure 2.

Re-check the alignment after final tightening of the bolts or studs.

Do not exceed permissible loading values for bearings as stated in the product catalogs.

Check that the motor has sufficient airflow. Ensure that no nearby objects or direct sunshine radiate additional heat to the motor.

For flange mounted motors (e.g. B5, B35, V1), make sure that the construction allows sufficient air flow on the outer surface of the flange.

4.7 Radial forces and belt drives

Belts must be tightened according to the instructions of the supplier of the driven equipment. However, do not exceed the maximum belt forces (i.e. radial bearing loading) stated in the relevant product catalogs.

WARNING!

Excessive belt tension will damage bearings and can cause shaft damage.

4.8 Motors with drain plugs for condensation

Check that drain holes and plugs face downwards. In vertical position mounted motors, the drain plugs may be in horizontal position.

Motors with sealable plastic drain plugs are delivered in an open position. In very dusty environments, all drain holes should be closed.

4.9 Cabling and electrical connections

The terminal box on standard single speed motors normally contains six winding terminals and at least one earth terminal.

In addition to the main winding and earthing terminals, the terminal box can also contain connections for thermistors, heating elements or other auxiliary devices.

Suitable cable lugs must be used for the connection of all main cables. Cables for auxiliaries can be connected into their terminal blocks as such.

Motors are intended for fixed installation only. Unless otherwise specified, cable entry threads are metric. The IP class of the cable gland must be at least the same as those of the terminal boxes.

Certified conduit hub or cable connector has to be used at the time of installation.

NOTE!

Cables should be mechanically protected and clamped close to the terminal box to fulfill the appropriate requirements of IEC/EN 60079-0 and local installation standards.

Unused cable entries must be closed with blanking elements according to the IP class of the terminal box.

The degree of protection and diameter are specified in the documents relating to the cable gland.

WARNING!

Use appropriate cable glands and seals in the cable entries according to the type and diameter of the cable.

Earthing must be carried out according to local regulations before the motor is connected to the supply voltage.

The earth terminal on the frame has to be connected to PE (protective earth) with a cable as shown in Table 5 of IEC/EN 60034-1:

Minimum cross-sectional area of protective conductors

Cross-sectional area of phase conductors of the installation, S, [mm ²]	Minimum cross-sectional area of the corresponding protective conductor, S, [mm ²]
4	4
6	6
10	10
16	16
25	25
35	25
50	25
70	35
95	50
120	70
150	70
185	95
240	120
300	150
400	185

In addition, earthing or bonding connection facilities on the outside of electrical apparatus must provide effective connection of a conductor with a cross-sectional area of at least 4 mm².

The cable connection between the network and motor terminals must meet the requirements stated in the national standards for installation or in the standard IEC/EN 60204-1 according to the rated current indicated on the rating plate.

NOTE!

When the ambient temperature exceeds +50 °C, cables having permissible operating temperature of +90 °C as minimum shall be used. Also all other conversion factors depending on the installation conditions shall be taken into account while sizing the cables.

Ensure that the motor protection corresponds to the environment and weather conditions. For example, make sure that water cannot enter the motor or the terminal boxes.

The seals of terminal boxes must be placed correctly in the slots provided to ensure the correct IP class. A leak could lead to penetration of dust or water, creating a risk of flashover to live elements.

4.9.1 Connections for different starting methods

The terminal box on standard single speed motors normally contains six winding terminals and at least one earth terminal. This enables the use of DOL- or Y/D –starting.

For two-speed and special motors, the supply connection must follow the instructions inside the terminal box or in the motor manual.

The voltage and connection are stamped on the rating plate.

Direct-on-line starting (DOL):

Y or D winding connections may be used.

For example, 690 VY, 400 VD indicates Y-connection for 690 V and D-connection for 400 V.

Star/Delta (Wye/Delta) starting (Y/D):

The supply voltage must be equal to the rated voltage of the motor when using a D-connection.

Remove all connection links from the terminal block.

Other starting methods and severe starting conditions:

In cases where other starting methods e.g. converter or soft starter will be used in the duty types of S1 and S2, it is considered that the device is “isolated from the power system when the electrical machine is running” as in the standard IEC 60079-0 and thermal protection is optional.

4.9.2 Connections of auxiliaries

If a motor is equipped with thermistors or other RTDs (Pt100, thermal relays, etc.) and auxiliary devices, it is recommended they be used and connected by appropriate means. For certain applications, it is mandatory to use thermal protection. More detailed information can be found in the documents delivered with the motor. Connection diagrams for auxiliary elements and connection parts can be found inside the terminal box.

The maximum measuring voltage for the thermistors is 2.5 V. The maximum measuring current for Pt100 is 5 mA. Using a higher measuring voltage or current may cause errors in readings or a damaged temperature detector.

The insulation of thermal sensors fulfills the requirements of basic insulation.

4.10 Terminals and direction of rotation

The shaft rotates clockwise when viewing the shaft face at the motor drive end, and the line phase sequence – L1, L2, L3 – is connected to the terminals as shown in figure 3.

To alter the direction of rotation, interchange any two connections on the supply cables.

If the motor has a unidirectional fan, ensure that it rotates in the same direction as the arrow marked on the motor.

5. Operation

5.1 General

The motors are designed for the following conditions unless otherwise stated on the rating plate:

- Motors are to be installed in fixed installations only.
- Normal ambient temperature range is from $-20\text{ }^{\circ}\text{C}$ to $+40\text{ }^{\circ}\text{C}$.
- Maximum altitude is 1000 m above sea level.
- The variation of the supply voltage and frequency may not exceed the limits mentioned in relevant standards. Tolerance for supply voltage is $\pm 5\%$, and for frequency $\pm 2\%$ according to the figure 4 (EN / IEC 60034-1, paragraph 7.3, Zone A). Both extreme values are not supposed to occur at the same time.

The motor can only be used in applications for which it is intended. The rated nominal values and operation conditions are shown on the motor rating plates. In addition, all requirements of this manual and other related instructions and standards must be followed.

If these limits are exceeded, motor data and construction data must be checked. Please contact ABB for further information.

WARNING!

Ignoring any instructions or maintenance of the apparatus may jeopardize safety and thus prevent the use of the motor.

6. Low voltage motors in variable speed operation

6.1 Introduction

This part of the manual provides additional instructions for motors used in frequency converter supplies. The motor is intended to operate from a single frequency converter supply and not motors running in parallel from one frequency converter. Instructions given by the converter manufacturer shall be followed.

Additional information may be required by ABB to decide on the suitability for some motor types used in special applications or with special design modifications.

6.2 Winding insulation

Variable speed drives create higher voltage stresses than the sinusoidal supply on the winding of the motor. Therefore, the winding insulation of the motor as well as the filter at the converter output must be dimensioned according following instructions.

6.2.1 Selection of winding insulation for ABB converters

In the case of ABB e.g. AC_8_ _-series and AC_5_ _-series single drives with a diode supply unit (uncontrolled DC voltage), the selection of winding insulation and filters can be made according to table 6.1.

6.2.2 Selection of winding insulation with all other converters

The voltage stresses must be limited below accepted limits. Please contact the system supplier to ensure the safety of the application. The influence of possible filters must be taken into account while dimensioning the motor.

6.3 Thermal protection

Most of the motors covered by this manual are equipped with PTC thermistors or other type of RTD's in the stator windings. It is recommended to connect those to the frequency converter. Read more in chapter 4.9.2.

6.4 Bearing currents

Insulated bearings or bearing constructions, common mode filters and suitable cabling and grounding methods must be used according to the following instructions and using table 6.1.

6.4.1 Elimination of bearing currents with ABB converters

In case of ABB frequency converter e.g. AC_8_ _- and AC_5_ _-series with a diode supply unit, the methods according to table 6.1 must be used to avoid harmful bearing currents in motors.

	$P_N < 100 \text{ kW}$	$P_N \geq 100 \text{ kW or IEC315} \leq \text{Frame size} \leq \text{IEC355}$	$P_N \geq 350 \text{ kW or IEC400} \leq \text{Frame size} \leq \text{IEC450}$
$U_N \leq 500 \text{ V}$	Standard motor	Standard motor + Insulated N-bearing	Standard motor + Insulated N-bearing + Common mode filter
$500\text{V} > U_N \leq 600\text{V}$	Standard motor + dU/dt –filter (reactor) OR Reinforced insulation	Standard motor + dU/dt –filter (reactor) + Insulated N-bearing OR Reinforced insulation + Insulated N-bearing	Standard motor + Insulated N-bearing + dU/dt –filter (reactor) + Common mode filter OR Reinforced insulation + Insulated N-bearing + Common mode filter
$500\text{V} > U_N \leq 600\text{V}$ (cable length > 150 m)	Standard motor	Standard motor + Insulated N-bearing	Standard motor + Insulated N-bearing + Common mode filter
$600\text{V} > U_N \leq 690\text{V}$	Reinforced insulation + dU/dt –filter (reactor)	Reinforced insulation + dU/dt –filter (reactor) + Insulated N-bearing	Reinforced insulation + Insulated N-bearing + dU/dt –filter (reactor) + Common mode filter
$600\text{V} > U_N \leq 690\text{V}$ (cable length > 150 m)	Reinforced insulation	Reinforced insulation + Insulated N-bearing	Reinforced insulation + Insulated N-bearing + Common mode filter

Table 6.1 Selection of winding insulation for ABB converters

Please contact ABB for more information on resistor braking and converters with controlled supply units.

NOTE!

Insulated bearings which have aluminum oxide coated inner and/or outer bores or ceramic rolling elements are recommended. Aluminum oxide coatings shall also be treated with a sealant to prevent dirt and humidity penetrating into the porous coating. For the exact type of bearing insulation, see the motor's rating plate. Changing the bearing type or insulation method without ABB's permission is prohibited.

6.4.2 Elimination of bearing currents with all other converters

The user is responsible for protecting the motor and driven equipment from harmful bearing currents. Instructions described in chapter 6.4.1 can be used as guideline, but their effectiveness cannot be guaranteed in all cases.

6.5 Cabling, grounding and EMC

To provide proper grounding and to ensure compliance with any applicable EMC requirements, motors above 30 kW shall be cabled by shielded symmetrical cables and EMC glands, i.e. cable glands providing 360° bonding.

Symmetrical and shielded cables are highly recommended also for smaller motors. Make the 360° grounding arrangement at all the cable entries as described in the instructions for the glands. Twist the cable shields into bundles and connect to the nearest ground terminal/bus bar inside the terminal box, converter cabinet, etc.

NOTE!

Proper cable glands providing 360° bonding must be used at all termination points such as motor, converter, possible safety switch, etc.

For motors of frame size IEC 280 and above, additional potential equalization between the motor frame and the driven equipment is needed, unless both are mounted on a common steel base. In this case, the high frequency conductivity of the connection provided by the steel base should be checked by, for example, measuring the potential difference between the components.

More information about grounding and cabling of variable speed drives can be found in the manual "Grounding and cabling of the drive system" (Code: 3AFY 61201998).

6.6 Operating speed

For speeds higher than the nominal speed stated on the motor's rating plate or in the respective product catalog, ensure that either the highest permissible rotational speed of the motor or the critical speed of the whole application is not exceeded.

6.7 Motors in variable speed applications

6.7.1 General

With ABB's frequency converters, the motors can be dimensioned by using ABB's DriveSize dimensioning program. The tool is downloadable from the ABB website (www.abb.com/motors&generators).

For application supplied by other converters, the motors must be dimensioned manually. For more information, please contact ABB.

The loadability curves (or load capacity curves) are based on nominal supply voltage. Operation in under or over voltage conditions may influence on the performance of the application.

6.7.2 Motor loadability with AC_8__ – series of converters with DTC control

The loadability curves presented in Figures 5a – 5d are valid for ABB AC_8__-series converters with uncontrolled DC-voltage and DTC-control. The figures show the approximate maximum continuous output torque of the motors as a function of supply frequency. The output torque is given as a percentage of the nominal torque of the motor. The values are indicative and exact values are available on request.

NOTE!

The maximum speed of the motor and application may not be exceeded!

6.7.3 Motor loadability with AC_5__ – series of converter

The loadability curves presented in Figures 6a – 6d are valid for AC_5__-series converters. The figures show the approximate maximum continuous output torque of the motors as a function of supply frequency. The output torque is given as a percentage of the nominal torque of the motor. The values are indicative and exact values are available on request.

NOTE!

The maximum speed of the motor and application may not be exceeded!

6.7.4 Motor loadability with other voltage source PWM-type converters

For other converters, with uncontrolled DC voltage and minimum switching frequency of 3 kHz (200...500 V), the dimensioning instructions as mentioned in chapter 6.7.3 can be used as guidelines. However, it shall be noted that the actual thermal loadability can also be lower. Please contact the manufacturer of the converter or the system supplier.

NOTE!

The actual thermal loadability of a motor may be lower than shown by guideline curves.

6.7.5 Short time overloads

ABB motors can usually be temporarily overloaded as well as used in intermittent duties. The most convenient method to dimension such applications is to use the DriveSize tool.

6.8 Rating plates

The usage of ABB's motors in variable speed applications do not usually require additional rating plates. The parameters required for commissioning the converter can be found from the main rating plate. In some special applications, however, the motors can be equipped with additional rating plates for variable speed applications. Those include the following information:

- speed range
- power range
- voltage and current range
- type of torque (constant or quadratic)
- and converter type and required minimum switching frequency.

6.9 Commissioning the variable speed application

The commissioning of the variable speed application must be done according to the instructions of the frequency converter and local laws and regulations. The requirements and limitations set by the application must also be taken into account.

All parameters needed for setting the converter must be taken from the motor rating plates. The most often needed parameters are:

- nominal voltage
- nominal current
- nominal frequency
- nominal speed
- nominal power

NOTE!

In case of missing or inaccurate information, do not operate the motor before ensuring correct settings!

ABB recommends using all the suitable protective features provided by the converter to improve the safety of the application. Converters usually provide features such as (names and availability of features depend on manufacturer and model of the converter):

- minimum speed
- maximum speed
- acceleration and deceleration times
- maximum current
- maximum torque
- stall protection

7. Maintenance

WARNING!

Voltage may be connected at standstill inside the terminal box for heating elements or direct winding heating.

7.1 General inspection

1. Inspect the motor at regular intervals, at least once a year. The frequency of checks depends on, for example, the humidity level of the ambient air and on the local weather conditions. This can initially be determined experimentally and must then be strictly adhered to.
2. Keep the motor clean and ensure free ventilation airflow. If the motor is used in a dusty environment, the ventilation system must be regularly checked and cleaned.
3. Check the condition of shaft seals (e.g. V-ring or radial seal) and replace if necessary.
4. Check the condition of connections and mounting and assembly bolts.
5. Check the bearing condition by listening for any unusual noise, vibration measurement, bearing temperature, inspection of spent grease or SPM bearing monitoring. Pay special attention to bearings when their calculated rated life time is coming to an end.

When signs of wear are noticed, dismantle the motor, check the parts and replace if necessary. When bearings are changed, replacement bearings must be of the same type as those originally fitted. The shaft seals have to be replaced with seals of the same quality and characteristics as the originals when changing bearings.

In the case of the IP 55 motor and when the motor has been delivered with a plug closed, it is advisable to periodically open the drain plugs in order to ensure that the way out for condensation is not blocked and allows condensation to escape from the motor. This operation must be done when the motor is at a standstill and has been made safe to work on.

7.1.1 Standby motors

If the motor is in standby for a longer period of time on a ship or in other vibrating environment the following measures have to be taken:

1. The shaft must be rotated regularly every 2 weeks (to be reported) by means of starting up of the system. In case a start-up is not possible, for any reason, at least the shaft has to be turned by hand in order to achieve a different position once a week. Vibrations caused by other vessel's equipment will cause bearing pitting which should be minimized by regular operation/hand turning.

2. The bearing must be greased while rotating the shaft every year (to be reported). If the motor has been provided with roller bearing at the driven end, the transport lock must be removed before rotating the shaft. The transport locking must be remounted in case of transportation.
3. All vibrations must be avoided to prevent a bearing from failing. All instructions in the motor instruction manual for commissioning and maintenance have to be followed. The warranty will not cover the winding and bearing damages if these instructions have not been followed.

7.2 Lubrication

WARNING!

Beware of all rotating parts!

WARNING!

Grease can cause skin irritation and eye inflammation. Follow all safety precautions specified by the manufacturer of the grease.

Bearing types are specified in the respective product catalogs and on the rating plate of all motors, except smaller frame sizes.

Reliability is a vital issue for bearing lubrication intervals. ABB uses mainly the L_1 -principle (i.e. that 99 % of the motors are certain to make the life time) for lubrication.

7.2.1 Motors with permanently greased bearings

Bearings are usually permanently greased bearings of 1Z, 2Z, 2RS or equivalent.

As a guide, adequate lubrication for sizes up to 250 can be achieved for the following duration, according to L_1 . For duties with higher ambient temperatures, please contact ABB. The informative formula to change the L_1 values roughly to L_{10} values: $L_{10} = 2.0 \times L_1$.

Duty hours for permanently greased bearings at ambient temperatures of 25 °C and 40 °C are:

Frame size	Poles	Duty hours at 25 °C	Duty hours at 40 °C
56	2	52 000	33 000
56	4–8	65 000	41 000
63	2	49 000	31 000
63	4–8	63 000	40 000
71	2	67 000	42 000
71	4–8	100 000	56 000
80–90	2	100 000	65 000
80–90	4–8	100 000	96 000
100–112	2	89 000	56 000
100–112	4–8	100 000	89 000
132	2	67 000	42 000
132	4–8	100 000	77 000
160	2	60 000	38 000
160	4–8	100 000	74 000
180	2	55 000	34 000
180	4–8	100 000	70 000
200	2	41 000	25 000
200	4–8	95 000	60 000
225	2	36 000	23 000
225	4–8	88 000	56 000
250	2	31 000	20 000
250	4–8	80 000	50 000

Data is valid up to 60 Hz.

7.2.2 Motors with regreasable bearings

Lubrication information plate and general lubrication advice

If the motor is equipped with a lubrication information plate, follow the given values.

Greasing intervals regarding mounting, ambient temperature and rotational speed are defined on the lubrication information plate.

During the first start or after a bearing lubrication a temporary temperature rise may appear, approximately 10 to 20 hours.

Some motors may be equipped with a collector for old grease. Follow the special instructions given for the equipment.

A. Manual lubrication

Regreasing while the motor is running

- Remove grease outlet plug or open closing valve if fitted.
- Be sure that the lubrication channel is open.
- Inject the specified amount of grease into the bearing.
- Let the motor run for 1-2 hours to ensure that all excess grease is forced out of the bearing. Close the grease outlet plug or closing valve, if fitted.

Regreasing while the motor is at a standstill

If it is not possible to re-grease the bearings while the motors are running, lubrication can be carried out while the motor is at a standstill.

- In this case, use only half the amount of grease and then run the motor for a few minutes at full speed.
- When the motor has stopped, apply the rest of the specified amount of grease to the bearing.
- After 1–2 running hours, close the grease outlet plug or closing valve, if fitted.

B. Automatic lubrication

The grease outlet plug must be removed permanently with automatic lubrication or open closing valve, if fitted.

ABB recommends only the use of electromechanical systems.

The amount of grease per lubrication interval stated in the table should be multiplied by three if a central lubrication system is used. When using a smaller automatic re-grease unit (one or two cartridges per motor) the normal amount of grease can be used.

When 2-pole motors are automatically re-greased, the note concerning lubricant recommendations for 2-pole motors in the Lubricants chapter should be followed.

The used grease should be suitable for automatic lubrication. The automatic lubrication system deliverer and the grease manufacturer's recommendations should check.

Calculation example of amount of grease for automatic lubrication system

Central lubrication system: Motor IEC M3_P 315_ 4-pole in 50 Hz network, re-lubrication interval according to Table is 7600 h/55 g (DE) and 7600 h/40 g (NDE):

$$(DE) RLI = 55 \text{ g}/7600 \text{ h} \cdot 3 \cdot 24 = 0,52 \text{ g/day}$$

$$(NDE) RLI = 40 \text{ g}/7600 \text{ h} \cdot 3 \cdot 24 = 0,38 \text{ g/day}$$

Calculation example of amount of grease for single automation lubrication unit (cartridge)

$$(DE) RLI = 55 \text{ g}/7600 \text{ h} \cdot 24 = 0,17 \text{ g/day}$$

$$(NDE) RLI = 40 \text{ g}/7600 \text{ h} \cdot 24 = 0,13 \text{ g/day}$$

RLI = Re-lubrication interval, DE = Drive end, NDE = Non drive end

7.2.3 Lubrication intervals and amounts

Lubrication intervals for vertical motors are half of the values shown in the table below.

As a guide, adequate lubrication can be achieved for the following duration, according to L_1 . For duties with higher ambient temperatures please contact ABB. The informative formula to change the L_1 values roughly to L_{10} values is $L_{10} = 2.0 \times L_1$, with manual lubrication.

The lubrication intervals are based on a bearing operating temperature of 80 °C (ambient temperature +25 °C).

NOTE!

An increase in the ambient temperature raises the temperature of the bearings correspondingly. The interval values should be halved for a 15 °C increase in bearing temperature and may be doubled for a 15 °C decrease in bearing temperature.

Higher speed operation, e.g. in frequency converter applications, or lower speed with heavy load will require shorter lubrication intervals.

WARNING!

The maximum operating temperature of the grease and bearings, +110 °C, must not be exceeded. The designed maximum speed of the motor must not be exceeded.

Frame size	Amount of grease g/bearing	kW	3600 r/min	3000 r/min	kW	1800 r/min	1500 r/min	kW	1000 r/min	kW	500-900 r/min
Ball bearings, lubrication intervals in duty hours											
112	10	all	10 000	13 000	all	18 000	21 000	all	2 5 000	all	28 000
132	15	all	9 000	11 000	all	17 000	19 000	all	23 000	all	26 500
160	25	≤ 18,5	9 000	12 000	≤ 15	18 000	21 500	≤ 11	24 000	all	24 000
160	25	> 18,5	7 500	1 0000	> 15	15 000	18 000	> 11	22 500	all	24 000
180	30	≤ 22	7 000	9 000	≤ 22	15 500	18 500	≤ 15	24 000	all	24 000
180	30	> 22	6 000	8 500	> 22	14 000	17 000	> 15	21 000	all	24 000
200	40	≤ 37	5 500	8 000	≤ 30	14 500	17 500	≤ 22	23 000	all	24 000
200	40	> 37	3 000	5 500	> 30	10 000	12 000	> 22	16 000	all	20 000
225	50	≤ 45	4 000	6 500	≤ 45	13 000	16 500	≤ 30	22 000	all	24 000
225	50	> 45	1 500	2 500	> 45	5 000	6 000	> 30	8 000	all	10 000
250	60	≤ 55	2 500	4 000	≤ 55	9 000	11 500	≤ 37	15 000	all	18 000
250	60	> 55	1 000	1 500	> 55	3 500	4 500	> 37	6 000	all	7 000
280 ¹⁾	60	all	2 000	3 500	—	—	—	—	—	—	—
280 ¹⁾	60	—	—	—	all	8 000	10 500	all	14 000	all	17 000
280	35	all	1 900	3 200	—	—	—	—	—	—	—
280	40	—	—	—	all	7 800	9 600	all	13 900	all	15 000
315	35	all	1 900	3 200	—	—	—	—	—	—	—
315	55	—	—	—	all	5 900	7 600	all	11 800	all	12 900
355	35	all	1 900	3 200	—	—	—	—	—	—	—
355	70	—	—	—	all	4 000	5 600	all	9 600	all	10 700
400	40	all	1 500	2 700	—	—	—	—	—	—	—
400	85	—	—	—	all	3 200	4 700	all	8 600	all	9 700
450	40	all	1 500	2 700	—	—	—	—	—	—	—
450	95	—	—	—	all	2 500	3 900	all	7 700	all	8 700

Roller bearings, lubrication intervals in duty hours											
160	25	≤ 18,5	4 500	6 000	≤ 15	9 000	10 500	≤ 11	12 000	all	12 000
160	25	> 18,5	3 500	5 000	> 15	7 500	9 000	> 11	11 000	all	12 000
180	30	≤ 22	3 500	4 500	≤ 22	7 500	9 000	≤ 15	12 000	all	12 000
180	30	> 22	3 000	4 000	> 22	7 000	8 500	> 15	10 500	all	12 000
200	40	≤ 37	2 750	4 000	≤ 30	7 000	8 500	≤ 22	11 500	all	12 000
200	40	> 37	1 500	2 500	> 30	5 000	6 000	> 22	8 000	all	10 000
225	50	≤ 45	2 000	3 000	≤ 45	6 500	8 000	≤ 30	11 000	all	12 000
225	50	> 45	750	1 250	> 45	2 500	3 000	> 30	4 000	all	5 000
250	60	≤ 55	1 000	2 000	≤ 55	4 500	5 500	≤ 37	7 500	all	9 000
250	60	> 55	500	750	> 55	1 500	2 000	> 37	3 000	all	3 500
280 ¹⁾	60	all	1 000	1 750	—	—	—	—	—	—	—
280 ¹⁾	70	—	—	—	all	4 000	5 250	all	7 000	all	8 500
280	35	all	900	1 600	—	—	—	—	—	—	—
280	40	—	—	—	all	4 000	5 300	all	7 000	all	8 500
315	35	all	900	1 600	—	—	—	—	—	—	—
315	55	—	—	—	all	2 900	3 800	all	5 900	all	6 500
355	35	all	900	1 600	—	—	—	—	—	—	—
355	70	—	—	—	all	2 000	2 800	all	4 800	all	5 400
400	40	all	—	1 300	—	—	—	—	—	—	—
400	85	—	—	—	all	1 600	2 400	all	4 300	all	4 800
450	40	all	—	1 300	—	—	—	—	—	—	—
450	95	—	—	—	all	1 300	2 000	all	3 800	all	4 400

¹⁾ M3AA

7.2.4 Lubricants

WARNING!

Do not mix different types of grease.

Incompatible lubricants may cause bearing damage.

When re-greasing, use only special ball bearing grease with the following properties:

- good quality grease with lithium complex soap and with mineral- or PAO-oil
- base oil viscosity 100-160 cST at 40 °C
- consistency NLGI grade 1.5 - 3 *)
- temperature range –30 °C - +120 °C, continuously

*) A stiffer end of scale is recommended for vertical mounted motors or in hot conditions.

The above mentioned grease specification is valid if the ambient temperature is above –30 °C or below +55 °C, and the bearing temperature is below 110 °C; otherwise, consult ABB regarding suitable grease.

Grease with the correct properties is available from all major lubricant manufacturers.

Admixtures are recommended, but a written guarantee must be obtained from the lubricant manufacturer, especially concerning EP admixtures, that admixtures do not damage bearings or the properties of lubricants at the operating temperature range.

WARNING!

In general, lubricants containing EP admixtures are not recommended. In some cases it can cause harm in the bearing, therefore its use has to be evaluated case by case together with lubricant suppliers.

The following high performance greases can be used:

- Mobil Unirex N2 or N3 (lithium complex base)
- Mobil Mobilith SHC 100 (lithium complex base)
- Shell Gadus S5 V 100 2 (lithium complex base)
- Klüber Klüberplex BEM 41-132 (special lithium base)
- FAG Arcanol TEMP110 (lithium complex base)
- Lubcon Turmogrease L 802 EP PLUS (special lithium base)
- Total Multis Complex S2 A (lithium complex base)

NOTE!

Always use high speed grease for high speed 2-pole motors where the speed factor is higher than 480,000 (calculated as $D_m \times n$ where D_m = average bearing diameter, mm; n = rotational speed, r/min).

The following greases can be used for high speed cast iron motors but not mixed with lithium complex greases:

- Klüber Klüber Quiet BQH 72-102 (polyurea base)
- Lubcon Turmogrease PU703 (polyurea base)

If other lubricants are used, check with the manufacturer that the qualities correspond to those of the above mentioned lubricants. The lubrication intervals are based on the listed high performance greases above. Using other greases can reduce the interval.

8. After Sales Support

8.1 Spare parts

Unless otherwise stated, spare parts must be original parts or approved by ABB.

When ordering spare parts, the motor serial number, full type designation and product code, as stated on the rating plate, must be specified.

8.2 Dismantling, re-assembly and rewinding

Rewinding should always be carried out by qualified repair shops.

Smoke venting and other special motors should not be rewound without first contacting ABB.

8.3 Bearings

Special care should be taken with the bearings.

These must be removed using pullers and fitted by heating or using special tools.

Bearing replacement is described in detail in a separate instruction leaflet available from the ABB Sales Office.

Any directions placed on the motor, such as labels, must be followed. The bearing types indicated on the rating plate must not be changed.

NOTE!

Any repair by the end user, unless expressly approved by the manufacturer, releases the manufacturer from responsibility to conformity.

9. Environmental requirements

Most of ABB's motors have a sound pressure level not exceeding 82 dB (A) (± 3 dB) at 50 Hz.

Values for specific motors can be found in the relevant product catalogs. At 60 Hz sinusoidal supply, the values are approximately 4 dB(A) higher compared to 50 Hz values stated in the product catalogs.

For sound pressure levels at frequency converter supplies, please contact ABB.

When motor(s) need to be scrapped or recycled, appropriate means, local regulations and laws must be followed.

10. Troubleshooting

These instructions do not cover all details or variations in equipment nor provide information for every possible condition to be met in connection with installation, operation or maintenance. Should additional information be required, please contact the nearest ABB Sales Office.

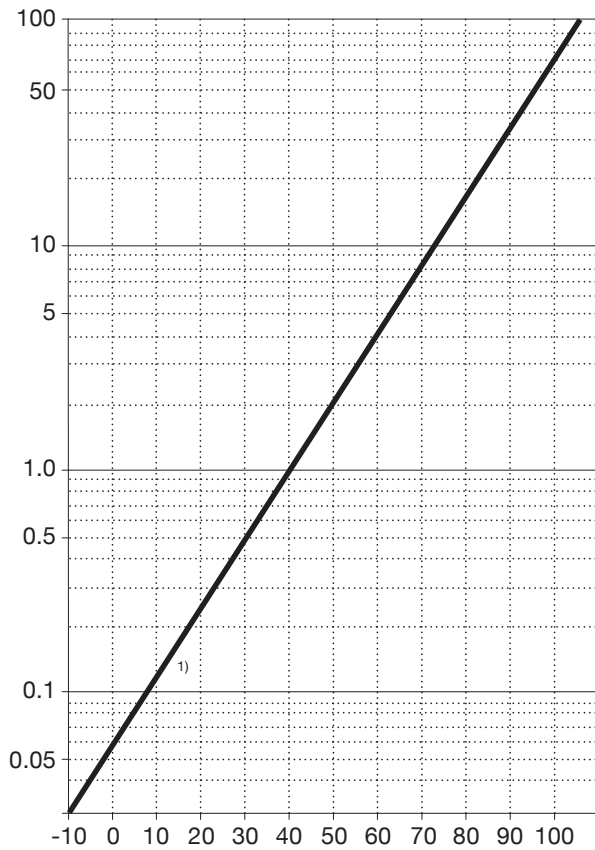
Motor troubleshooting chart

Your motor service and any troubleshooting must be handled by qualified persons who have the proper tools and equipment.

TROUBLE	CAUSE	WHAT TO DO
Motor fails to start	Blown fuses	Replace fuses with proper type and rating.
	Overload trips	Check and reset overload in starter.
	Improper power supply	Check to see that power supplied agrees with motor rating plate and load factor.
	Improper line connections	Check connections against diagram supplied with motor.
	Open circuit in winding or control switch	Indicated by humming sound when switch is closed. Check for loose wiring connections and ensure that all control contacts are closing.
	Mechanical failure	Check to see if motor and drive turn freely. Check bearings and lubrication.
	Short circuited stator	Contact ABB or Ensure that the supply is disconnected and grounding for work done, disconnect the cables and measure the insulation resistance.
	Poor stator coil connection	Indicated by blown fuses. Motor must be rewound. Remove end shields and locate fault.
	Motor may be overloaded	Reduce load.
Motor stalls	One phase may be open	Check lines for open phase.
	Wrong application	Change type or size. Consult equipment supplier.
	Overload	Reduce load.
	Low voltage	Ensure the rating plate voltage is maintained. Check connection.
	Open circuit	Fuses blown. Check overload relay, stator and push buttons.
Motor runs and then dies down	Power failure	Check for loose connections to line, fuses and control.
Motor does not accelerate up to nominal speed	Not applied properly	Consult equipment supplier for proper type.
	Voltage too low at motor terminals because of line drop	Use higher voltage or transformer terminals or reduce load. Check connections. Check conductors for proper size.
	Starting load too high	Check the motor's starts against "no load".
	Broken rotor bars or loose rotor	Look for cracks near the rings. A new rotor may be required, as repairs are usually temporary.
	Open primary circuit	Locate fault with testing device and repair.

TROUBLE	CAUSE	WHAT TO DO
Motor takes too long to accelerate and/or draws high current	Excessive load	Reduce load.
	Low voltage during start	Check for high resistance. Make sure that an adequate cable size is used.
	Defective squirrel cage rotor	Replace with new rotor.
	Applied voltage too low	Correct power supply.
Wrong rotation direction	Wrong sequence of phases	Reverse connections at motor or at switchboard.
Motor overheats while running	Overload	Reduce load.
	Frame or ventilation openings may be full of dirt and prevent proper ventilation of motor	Open vent holes and check for a continuous stream of air from the motor.
	Motor may have one phase open	Check to make sure that all leads and cables are well connected.
	Grounded coil	Motor must be rewound.
	Unbalanced terminal voltage	Check for faulty leads, connections and transformers.
Motor vibrates	Motor misaligned	Realign.
	Weak support	Strengthen base.
	Coupling out of balance	Balance coupling.
	Driven equipment unbalanced	Rebalance driven equipment.
	Defective bearings	Replace bearings.
	Bearings not in line	Repair motor
	Balancing weights shifted	Rebalance rotor.
	Contradiction between balancing of rotor and coupling (half key - full key)	Rebalance coupling or rotor.
	Poly phase motor running single phase	Check for open circuit.
	Excessive end play	Adjust bearing or add shim.
Scraping noise	Fan rubbing end shield or fan cover	Correct fan mounting.
	Loose on bedplate	Tighten holding bolts.
Noisy operation	Air gap not uniform	Check and correct end shield fits or bearing fits.
	Rotor unbalance	Rebalance rotor.
Hot bearings	Bent or sprung shaft	Straighten or replace shaft.
	Excessive belt pull	Decrease belt tension.
	Pulleys too far away from shaft shoulder	Move pulley closer to motor bearing.
	Pulley diameter too small	Use larger pulleys.
	Misalignment	Correct by realignment of the drive.
	Insufficient grease	Maintain proper quality and amount of grease in bearing.
	Deterioration of grease or lubricant contaminated	Remove old grease, wash bearings thoroughly in kerosene and replace with new grease.
	Excess lubricant	Reduce quantity of grease, bearing should not be more than half full.
	Overloaded bearing	Check alignment, side and end thrust.
	Broken ball or rough races	Replace bearing, clean housing thoroughly first.

11. Figures



Key

X-axis: Winding temperature, Celsius Degrees

Y-axis: Insulation Resistance Temperature Coefficient, ktc

1) To correct observed insulation resistance, R_i , to 40 °C multiply it by the temperature coefficient
 $k_{tc} \cdot R_{i\ 40\ ^\circ C} = R_i \times$

Figure 1. Diagram illustrating the insulation resistance dependence from the temperature and how to correct the measured insulation resistance to the temperature of 40 °C.

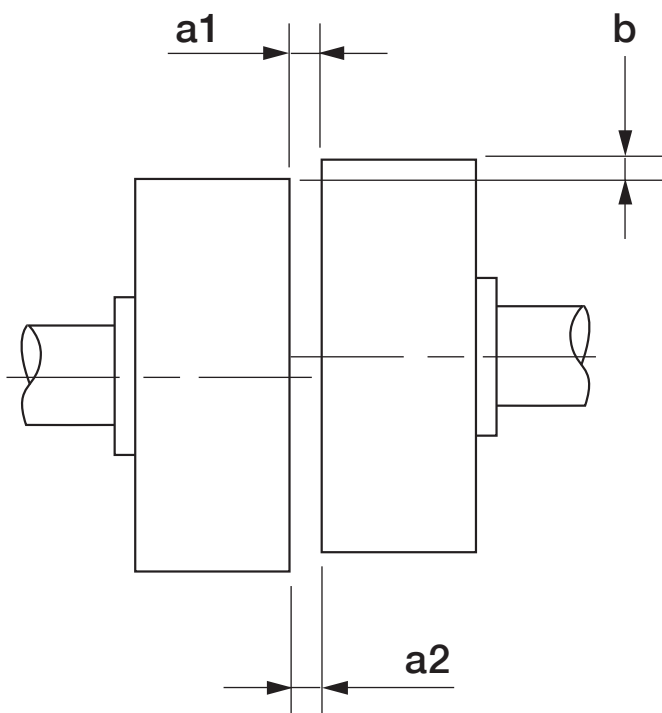


Figure 2. Mounting of half-coupling or pulley

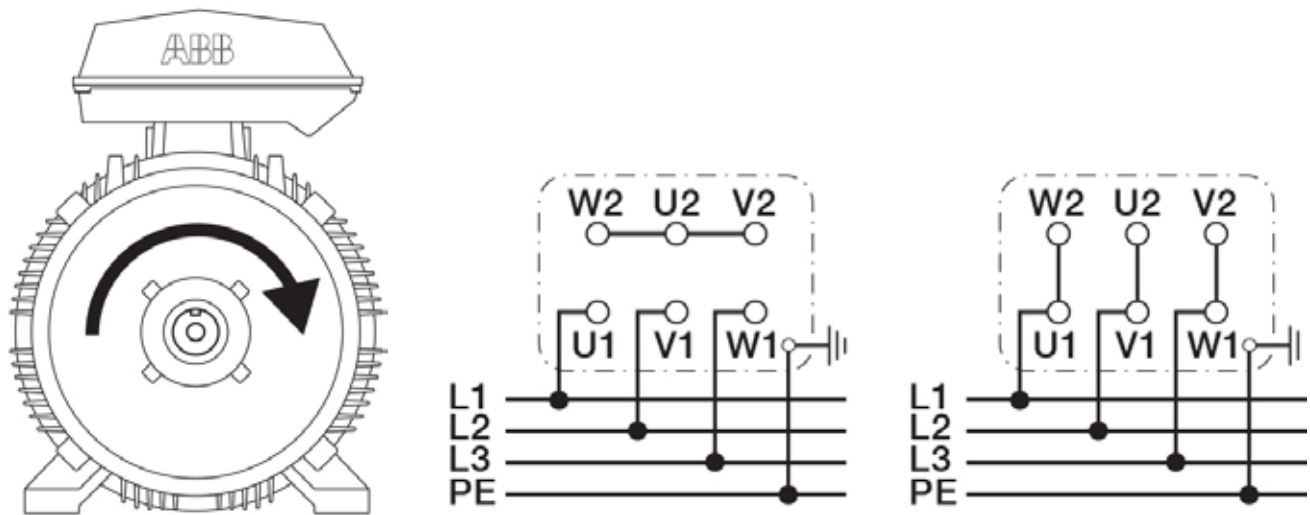


Figure 3. Connection of terminals for main supply

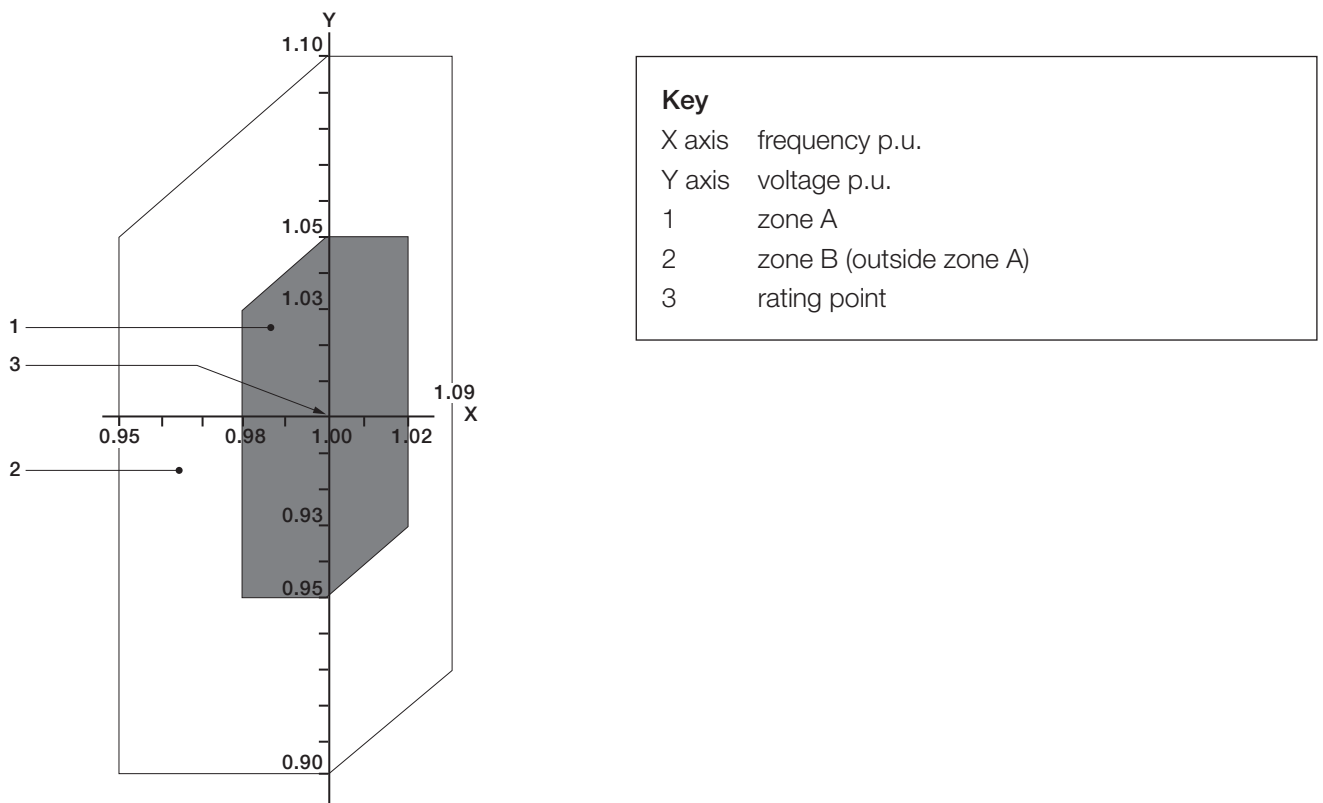


Figure 4. Voltage and frequency deviation in zones A and B

Guideline loadability curves with converters with DTC control

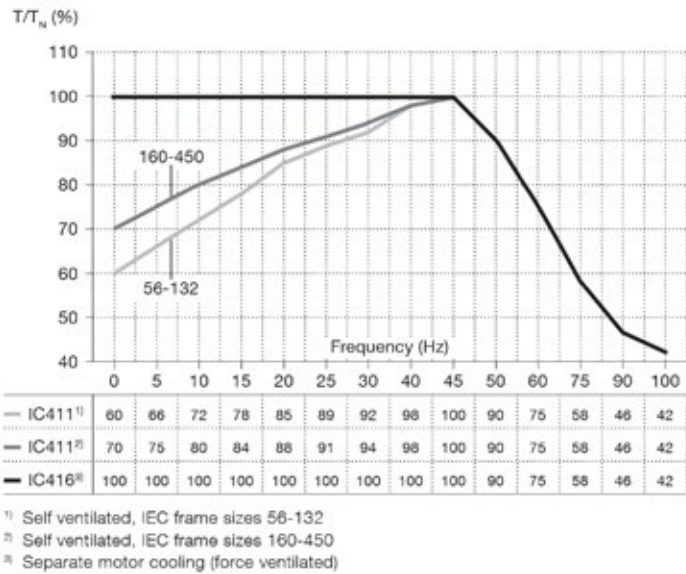


Figure 5a. Converter with DTC control, 50 Hz, temperature rise B

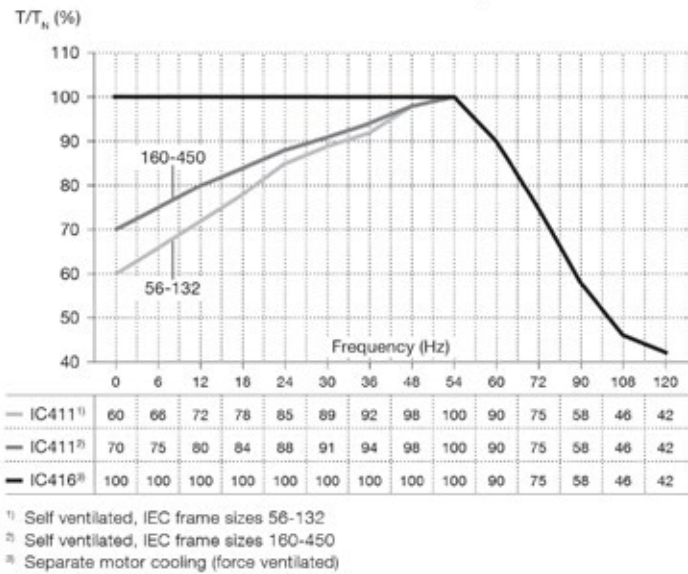


Figure 5b. Converter with DTC control, 60 Hz, temperature rise B

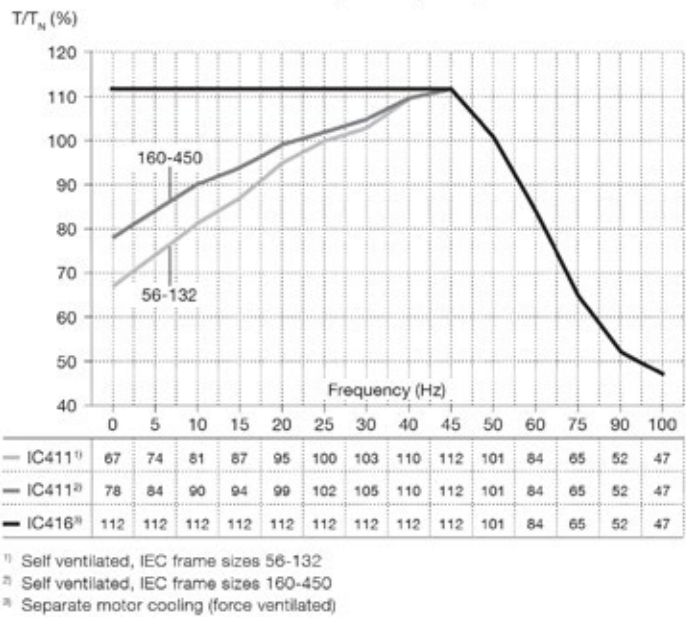


Figure 5c. Converter with DTC control, 50 Hz, temperature rise F

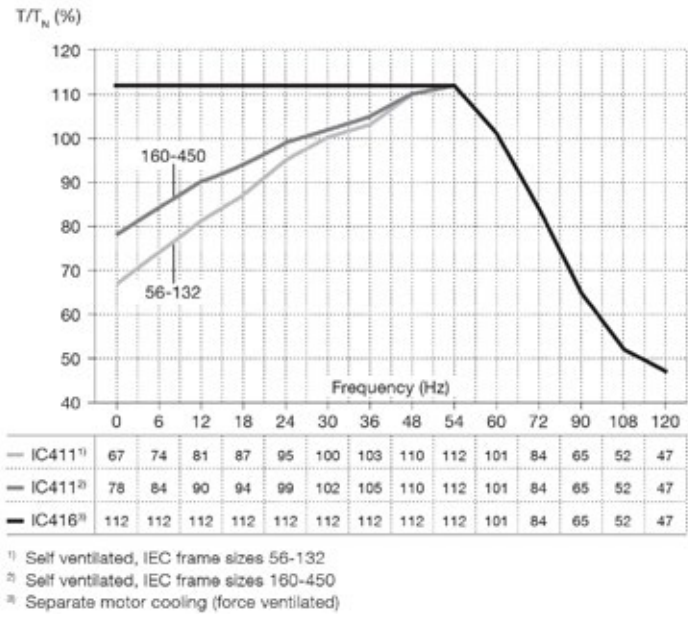


Figure 5d. Converter with DTC control, 60 Hz, temperature rise F

Guideline loadability curves with other voltage source PWM type

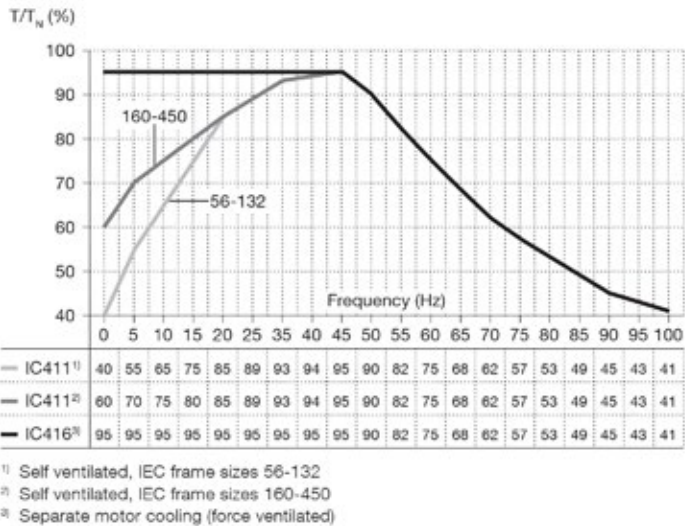


Figure 6a. Other voltage source PWM type converter, 50 Hz, temperature rise B

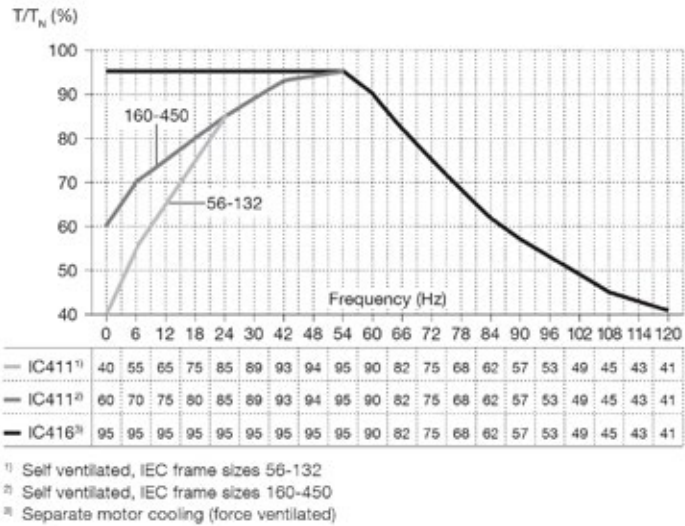


Figure 6b. Other voltage source PWM type converter, 60 Hz, temperature rise B

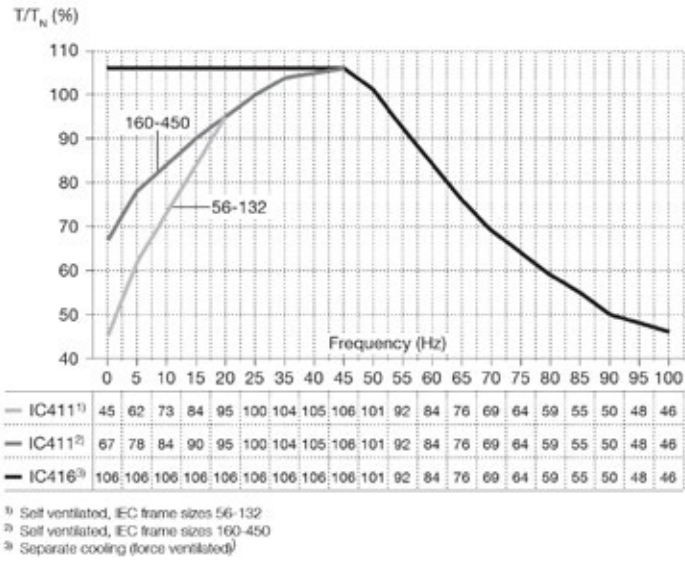


Figure 6c. Other voltage source PWM type converter, 50 Hz, temperature rise F

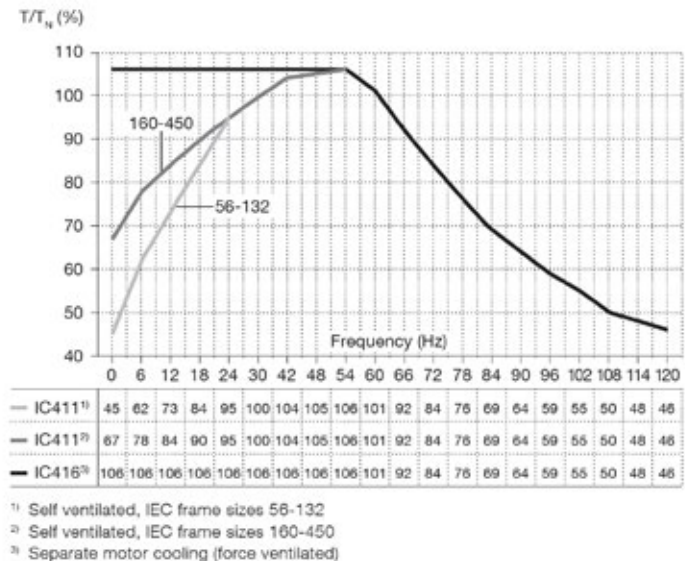


Figure 6d. Other voltage source PWM type converter, 60 Hz, temperature rise F

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