**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

aturia Rotos Marelli ALDOLI & BERTOLA ARIS CHAPPA

# INSTRUCTION MANUAL

## Vertical Pump

## Electric motor driven Vertical pump

| | | |
|---|---|---|
| Model | : | ELV-500S |
| Capacity | : | 0.75 $m^3/s.$ |
| Total Head | : | 5.30 m. |
| Speed | : | 993 rpm. |
| Electric Motor | : | 75 kw. |

Electric Pumping Station No. 10 (P10)

Talat Kriap Subdistrict, Bang Pa-in District

Phra Nakhon Si Ayutthaya Province

By

Green Technology Asia CO., LTD.

TÜVNORD TÜV NORD CERT GmbH ISO 9001 tuev-nord.de

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80/28 Moo 2 Tiwanon 48 Rd., T.Thasai A.Muang,
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โทร. 0-2580-8339 แฟกซ์ 0-2952-3397

# Technical Data

TÜVNORD
TÜV NORD CERT GmbH
ISO 9001
tuev-nord.de

ข้อที่ 33.1 ข้อที่ 1

# VERTICAL AXIAL FLOW PUMP

## Model: ELV-500S ข้อที่ 2

Gruppo Aturia

| | | | | |
|---|---|---|---|---|
| Offer n° : | Offer_BQBS8E00773S_R3 | Date : 23-May-24 | | |
| Customer : | RID_THAILAND | Item : P10 | | |
| Quantity : | 2 | Created by : Paolo Tresoldi | | |
| | | Capacity Q : 2700.00 | m3/h | |
| | REQUESTED DUTIES: | Head H : 5.30 | m | |
| | | R.P.M. : 993.00 | 1/min | |

### WORKING DATA AND PUMP CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Pumped liquid | Water | Pump length from baseplate to suction bell | 6.3 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 | ข้อที่ 9.7 |
| ข้อที่ 7.1 Capacity Q | 2700.00 m3/h | Bearings life minimum | 100000.00 hr | |
| ข้อที่ 7.2 Head TMH | 5.3 m | Impeller type | Open | |
| ข้อที่ 7.6 R.P.M. | 993.00 1/min | Rotation (pump view from motor side) | CCW | |
| Pump input at duty point | 46.69 kW | Shaft seal | Soft packing PTFE | ข้อที่ 8.6 |
| ข้อที่ 7.4 Bowl input at duty point | 46.39 kW | Bowl wear rings | Yes | |
| ข้อที่ 7.3 Effective efficiency | 84.00 % | Standard elastic coupling | Yes | |
| ข้อที่ 7.2 NPSH require | 6.25 m | Installation | Indoor | |
| Minimum submergence (Max.) | 1.50 mm | Ambient temperature | 0 +40 °C | |
| Operrate 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 | ข้อที่ 8.3, 9.3 |
| Max particle | 90.00 mm | Shaft vibratory torque at maximum load | <20% | |
| ข้อที่ 8.2 Axial thrust at duty point | 1239.00 kg | Statically and dynamically balanced | ISO 1940/1 G 6.3 | ข้อที่ 8.2 |
| No. of stages | 1.00 | Column pipe | ANSI/AWWA E101 | ข้อที่ 9.1 |
| | | Column Connection | FLANGE | |
| | | Line shaft | ANSI/AWWA E101 | ข้อที่ 9.3 |
| | | Line shaft Type | Open | |

### MATERIALS

| | | | | |
|---|---|---|---|---|
| ข้อที่ 8.1 **Pump bowl** | ASTM A48 Class 35 | **Column pipe** | ASTM A53 Grade A | ข้อที่ 9.1 |
| ข้อที่ 8.2 -Impeller hub / blades | ASTM A-Type CF8M | -Intermediate bearing | Silicon Carbide | ข้อที่ 9.6 |
| ข้อที่ 8.4 -Bowl wear rings | ASTM A-Type CF8M | -Shaft | ASTM A-Type 416 | ข้อที่ 9.3 |
| ข้อที่ 8.3 -Shaft | ASTM A-Type 416 | -Shaft sleeve | ASTM A-Type 416 | ข้อที่ 9.5 |
| ข้อที่ 8.5 -Bearings | Silicon Carbide | -Bearing bushes | Silicon Carbide | |
| -Screws | Stainless Steel | -Shaft coupling | Rigid Coupling | ข้อที่ 9.4 |
| ข้อที่ 9.2 **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 | ข้อที่ 10 |
| -Shaft | ASTM A-Type 416 | -Float switch | Yes | |
| -Screws | Stainless Steel | -Monitoring unit | Yes | |
| ข้อที่ 11 -Motor stool | ASTM A36 | | | |
| -Axial bearing | Anti-friction bearing | | | |

### ELECTRIC MOTOR (Y/D - Excluded)

| | | | | |
|---|---|---|---|---|
| Squirrel Cage Induction Motor | Power: 75.0 kw | Power margine: 1.61 | | ข้อที่ 13.9 |
| Totally Enclosed Fan Cooled | Speed: 993.0 rpm | 60.63% | | |
| 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. | -2200kg |
| -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 |
|---|---|---|
| | | |

ว่าที่ ร.อ.ธรรมณัฐ แก้วบุญส่ง
วิศวกรเครื่องกล สก.๒๙๗๐
โทร. ๐๘๑-๔๔๔-๔๖๖๗

GRUPPO ATURIA SPA
Marco Staderini

GREEN TECHNOLOGY ASIA Co.,Ltd.

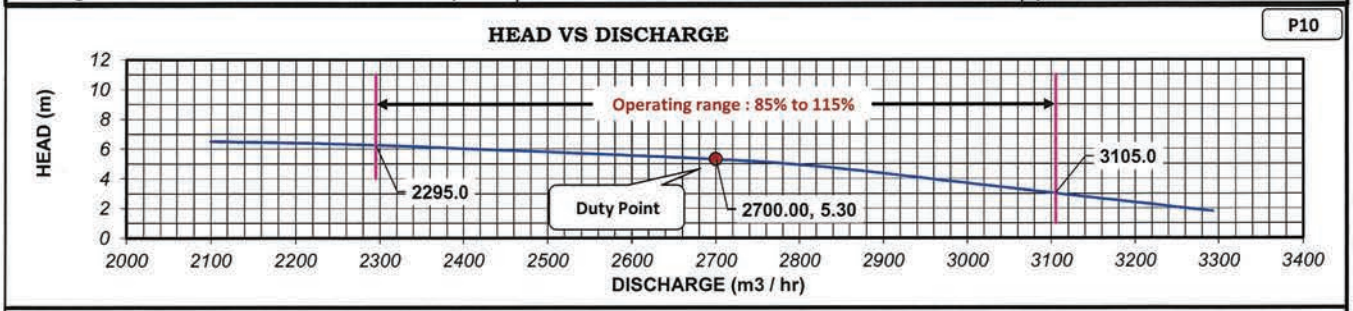
ข้อที่ 7.1, 7.2, 7.3, 7.4, 7.6, 13.26, 33.1

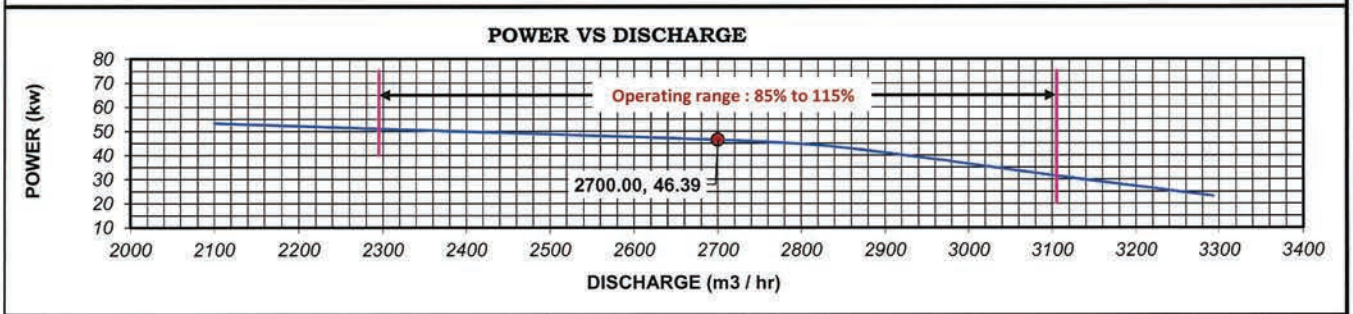
Gruppo Aturia

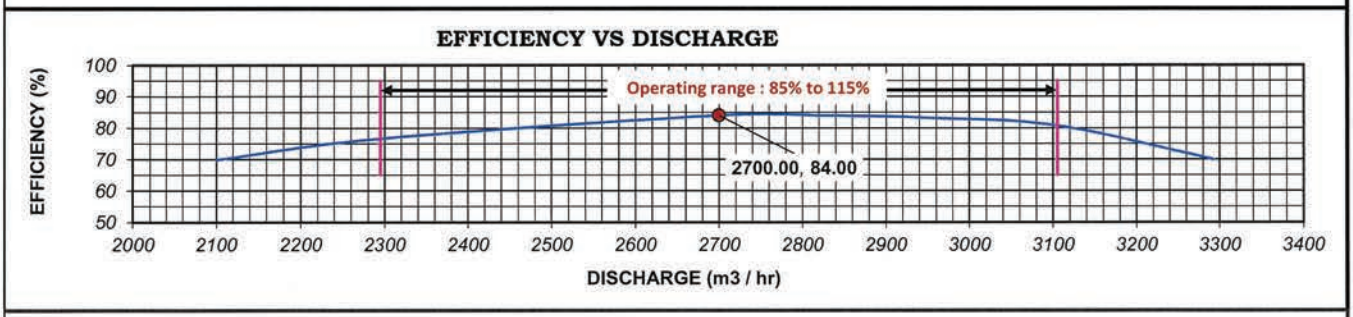
**TITLE : PUMP PERFORMANCE CURVE**
CLIENT : WPIL (THAILAND) CO. LTD
PROJECT :RID-BANG BAN3-PHRA NAKHON SI AYUTTHYA PROVINCE

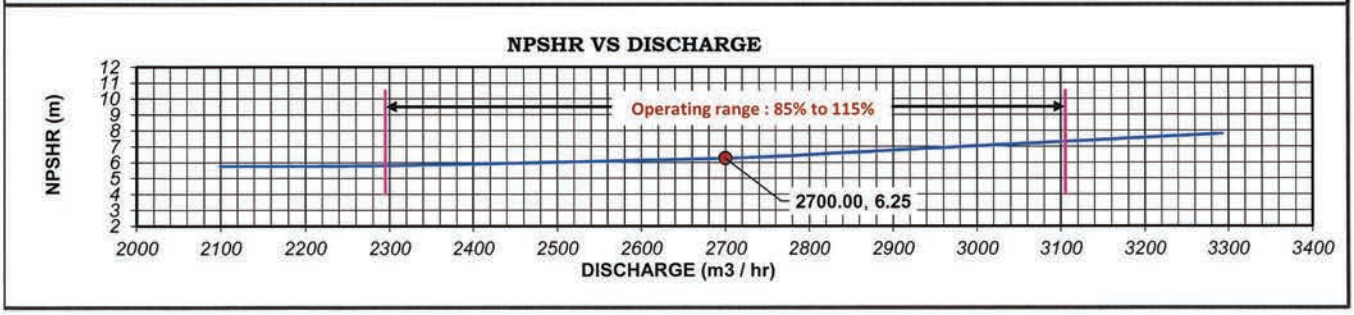
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Prep. by | : | Swapnanil Roy | | | | | |
| Doc. no. | : | IBU-8447-48-PC | | | | | |
| Rev. no. | : | 1 | | | | | |
| Date | : | 09 April 2024 | | | | | |
| Model | : | ELV-500S | Sp. Gr. | : | 1 | Stage(s) | : 1 |
| Discharge | : | 2700 m3/hr | Head | : | 5.3 mwc | Speed | : 993 |

P10



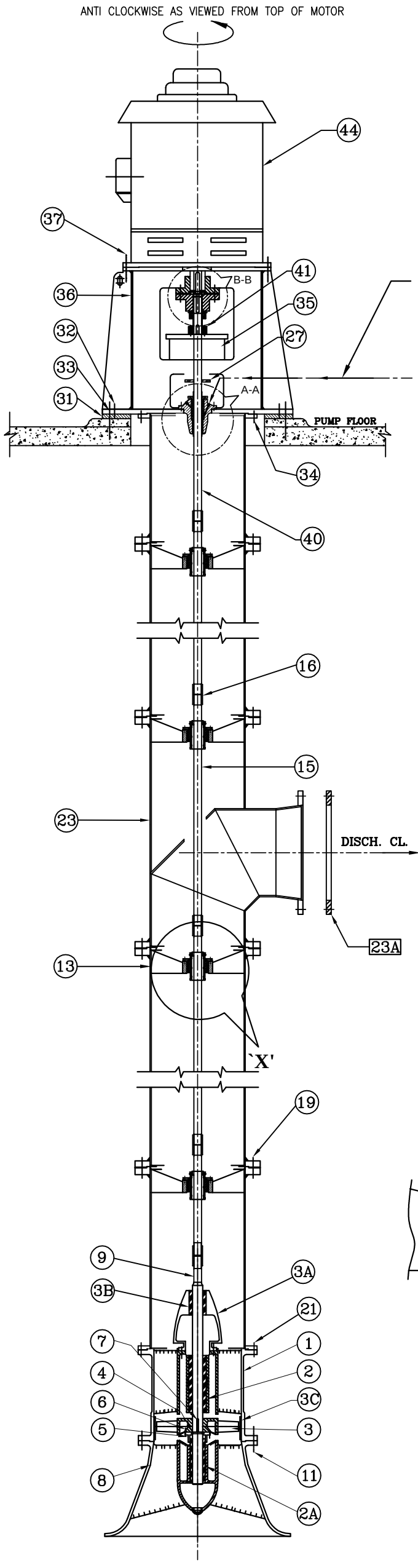




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วิศวกรเครื่องกล สก.๒๙๗๐
โทร. ๐๘๑-๔๔๔-๔๖๖๗

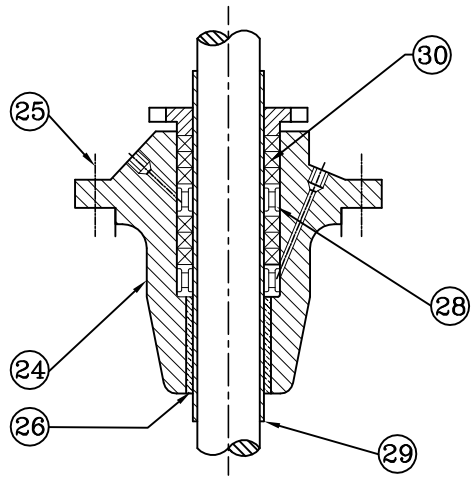
GREEN TECHNOLOGY ASIA Co.,Ltd

GRUPPO ATURIA SPA
Marco Staderini

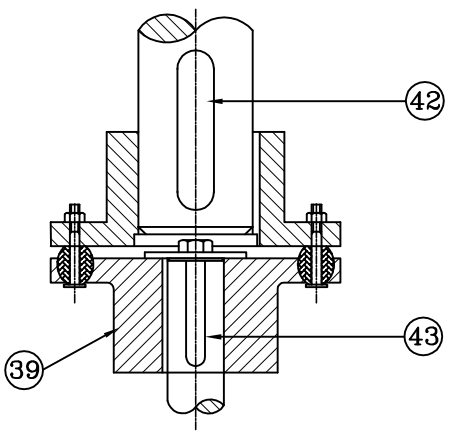
P10




CUSTOMER TO PROVIDE FILTERED WATER FOR STUFFING BOX BEARING LUBRICATION




DETAIL OF PACKING BOX
A-A




DETAIL OF FLEX. COUPLING
B-B

| PUMP THRUST BEARING HOUSING DETAILS | | |
|---|---|---|
| TYPE | ANTIFRICTION | |
| AXIAL TH. AT DP (Kg.) | 1239 | |
| 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.) | 2700 |
| TOTAL BOWL HEAD (MWC) | 5.30 |
| BOWL EFFICIENCY (%) | 84.00 |
| BOWL INPUT AT DP IN KW | 46.39 |
| PUMP INPUT AT DP IN KW | 46.69 |
| 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 |

PAINTING NOTE (EPOXY):-

* Pre-treatment shot blasting SA2.5 for all surfaces.

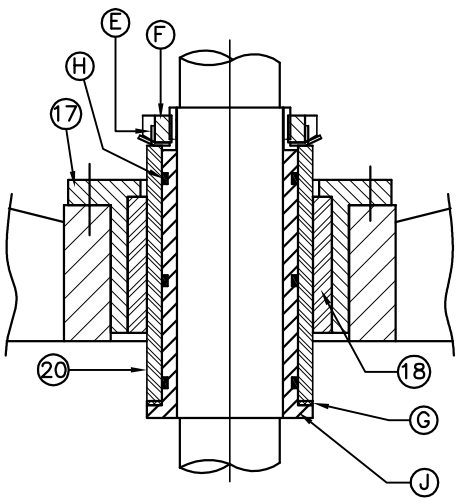
* Primer 0.1mm - 1 coat

* 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 |

| SL. NO. | DESCRIPTION | MATERIAL | REMARKS |
|---|---|---|---|
| 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 | |

BILL OF MATERIALS

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

GRUPPO ATURIA

SECTIONAL DRAWING FOR VERTICAL TURBINE PUMP

CLIENT : WPIL (THAILAND) CO. LTD.

PROJECT : RID_BANG BAN3_PHRA NAKHON SI AYUTTHAYA PROVINCE

SCALE : NONE

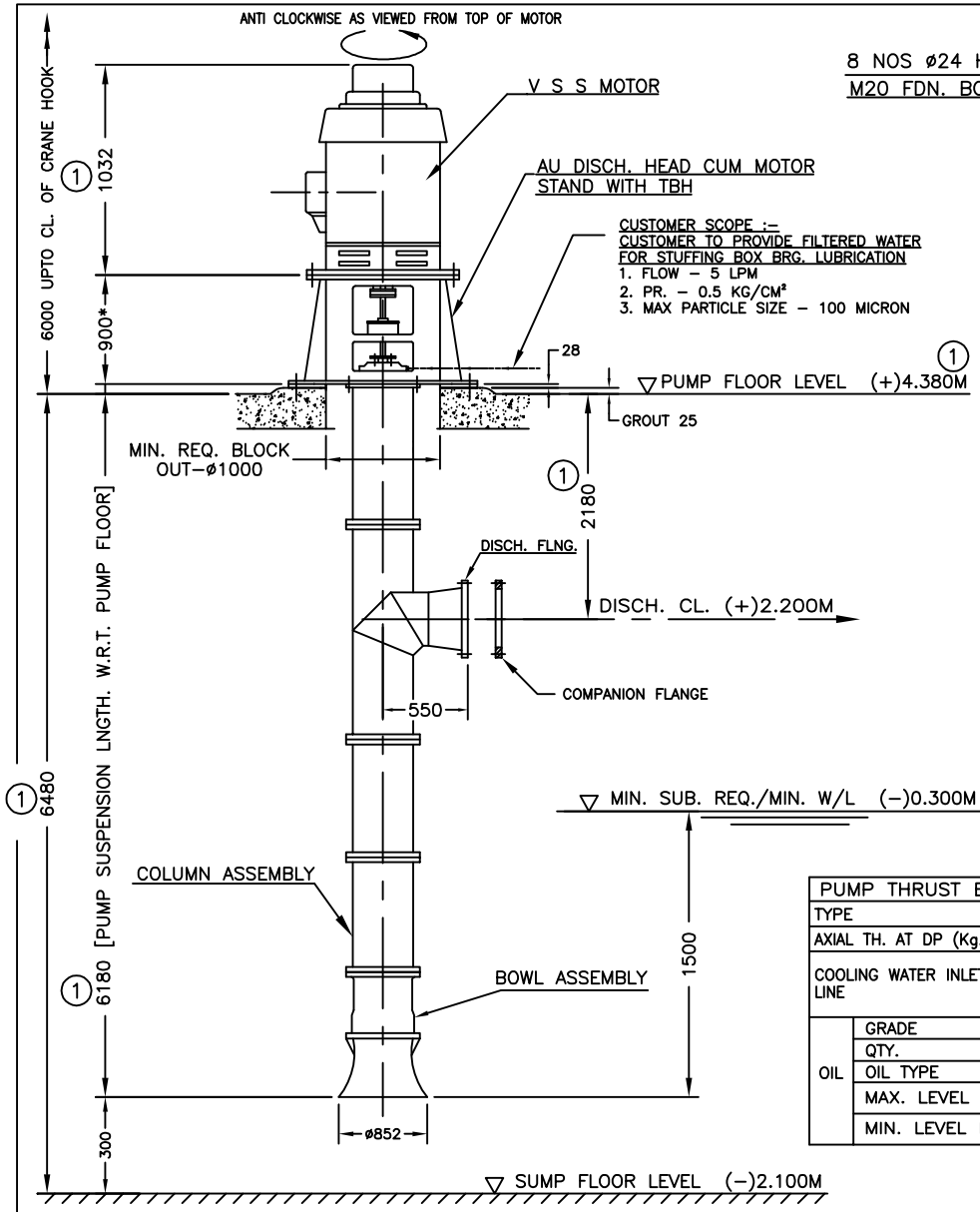
| | NAME | DATE |
|---|---|---|
| DRAWN | S.GHATAK | 19.03.24 |
| CHECKED | S.GHATAK | 19.03.24 |
| APPROVED | S.GHATAK | 19.03.24 |

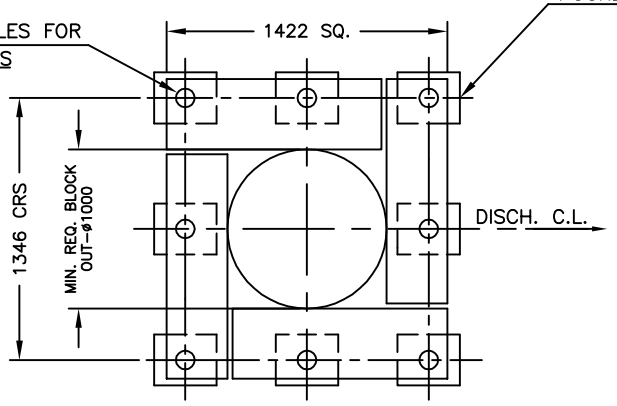
DRAWING NO. SK-12308-C

REV. 2

GA DRAWING NO. SK-12307-B

P10




PLAN OF SOLE PLATE AT PUMP FLOOR LEVEL (+)4.380M (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.) | 2700 |
| TOTAL BOWL HEAD (MWC) | 5.30 |
| BOWL EFFICIENCY (%) | 84.00 |
| BOWL INPUT AT DP IN KW | 46.39 |
| PUMP INPUT AT DP IN KW | 46.69 |
| SP. GR. OF WATER | 1.00 |

(1) LOAD DATA :

| | | | |
|---|---|---|---|
| STATIC LOAD (KG.) | 1) WT. OF MOTOR (Apprx.) | 930 | ↓ |
| | 2) WT. OF EMPTY PUMP | 2515 | ↓ |
| | 3) TOTAL DEAD WEIGHT | 3445 | ↓ |
| DYNAMIC LOAD (KG.) | 1) RESULTANT VERTICAL LOAD ON FOUNDATION(MAX.) (Fv, DISTRIBUTED OVER SOLE PLATE) | 5262 | ↓ |
| | 2) RESULTANT HORIZONTAL LOAD ON FOUNDATION(MAX.) (FH, ACTING ALONG PUMP DISCH. CL, IN REVERSE DIRECTION TO FLOW) | 2332 | ← |
| GD² VALUE (Kg.-M²) | PUMP | 4.25 | |

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 |

PUMP THRUST BEARING HOUSING DETAILS

| | | |
|---|---|---|
| TYPE | ANTIFRICTION | |
| AXIAL TH. AT DP (Kg.) | 1239 | |
| 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.

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

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-12307-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<br>NP | Customer name | | Customer ref | Item name<br>1.00001 |
| Our ref. | Rev/Changed by<br>A | Date of issue<br>8/16/2023 | Saving ident<br>untitled.xlsm | Pages<br>1(3) |

| No. | Definition | Data | Unit | Remarks | |
|---|---|---|---|---|---|
| 1 | Product (ข้อที่ 13.4, 13.7, 13.14) | *TEFC, 3-phase, squirrel cage induction motor* | | | |
| 2 | Product code | *3GBP 313 230-BDM* | | Calc. ref. | 3GZF021031-132 |
| 3 | Type/Frame (ข้อที่ 13.2) | *M3BP 315SMC 6* | | | |
| 4 | Mounting (ข้อที่ 13.5, 13.6) | *IM3011, V1(flange)* | | IEC 60034-7 | |
| 5 | Rated output $P_N$ (ข้อที่ 13.10) | *75* | kW | | |
| 6 | Service factor (ข้อที่ 13.13) | *1* | | | |
| 7 | Type of duty (ข้อที่ 13.16) | *S1(IEC) 100%* | | | |
| 8 | Rated voltage $U_N$ (ข้อที่ 13.7) | *380* | VD | ± 5 % (IEC 60034-1) | |
| 9 | Rated frequency $f_N$ (ข้อที่ 13.16) | *50* | Hz | ± 2 % (IEC 60034-1) | |
| 10 | Rated speed $n_N$ (ข้อที่ 13.8) | *993* | r/min | | |
| 11 | Rated current $I_N$ | *143* | A | | |
| 12 | No-load current | *40* | A | | |
| 13 | Starting current $I_s/I_N$ (ข้อที่ 13.15) | *6.3* | | Meet IEC 60034-12, N,(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 (ข้อที่ 13.11) | *100* | **143** | **95.4 / IE4** | **0.84** (ข้อที่ 13.12, 13.28) |
| 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 (ข้อที่ 13.18) | *F / B (155°C/80°C)* | | *IEC 60085 , VPI process* | |
| 26 | Ambient temperature (ข้อที่ 13.16) | *40* | °C | | |
| 27 | Altitude | *1000* | m.a.s.l. | | |
| 28 | Enclosure (ข้อที่ 13.14) | *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) (ข้อที่ 13.19) | *67* | dB(A) | at load | |
| 33 | Moment of inertia J = ¼ GD2 | *4.9* | kg-m2 | | |
| 34 | Balancing | | | | |
| 35 | Vibration class (ข้อที่ 13.19) | *A* | | IEC 60034-14 | |
| 36 | Position of terminal box (ข้อที่ 13.25) | *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 (ข้อที่ 13.17) | *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 (ข้อที่ 13.27) + SPM-Nipple at Bearing DE,NDE for Shock-Pulse Measuring
(ข้อที่ 13.20) + Pt100 3-wire in stator winding, 1 per phase + NDE Insulation Bearing (ข้อที่ 13.27)
(ข้อที่ 13.14) + Aluminum cooling fan + Stator winding and Rotor winding : Copper (ข้อที่ 13.23)
+ Painting system C5M acc. to ISO 12944-2:1998 / Special paint color, standard grade (RAL 5002) (ข้อที่ 13.30)
+ Insulated bearing at N-End
(ข้อที่ 13.22, 13.27) + Grease valve/SPM nipples, Grease nipples, Acid proof bolts : Stainless steel
+ Space Heater 200v. 50Hz. (ข้อที่ 13.21)

Remarks:

Data based on situation 7/13/2022
All data subject to tolerances in accordance with IEC
Guaranteed values on request

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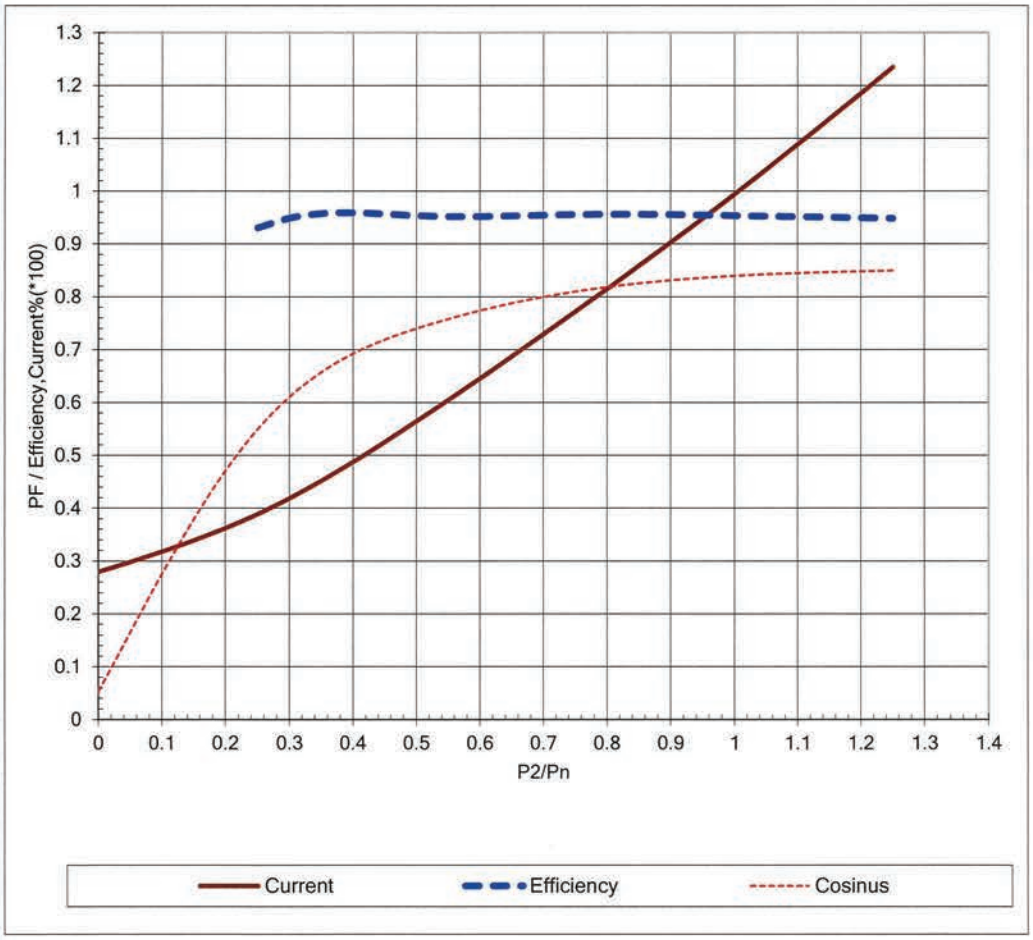
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ข้อที่ 33.2

| IEC LV Motors | Load Curves | | |
|---|---|---|---|
| | Project | Location | ABB |
| Department/Author | Customer name | Customer ref | Item name |
| NP | | | 1.00001 |
| Our ref. | Rev/Changed by Date of issue | Saving ident | Pages |
| | A 8/16/2023 | untitled.xlsm | 2(3) |

| | | | |
|---|---|---|---|
| Product | TEFC, 3-phase, squirrel cage induction motor | | |
| Type/Frame | M3BP 315SMC 6 | Calc. ref. | 3GZF021031-132 |
| Product code | 3GBP 313 230-BDM | | |
| Rated output $P_N$ | 75 kW | | |
| Type of duty | S1(IEC) 100% | | |

| | | | | | |
|---|---|---|---|---|---|
| Voltage (V) | 380 | Current $I_N$ (A) | 143 | Power factor at $P_N$ | 0.84 |
| Frequency (Hz) | 50 | Speed (r/min) | 993 | Efficiency (%) at $P_N$ | 95.4 |




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

All data subject to tolerances in accordance with IEC

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วิศวกรเครื่องกล สก.๒๙๗๐
โทร. ๐๘๑-๔๔๔-๔๖๖๗

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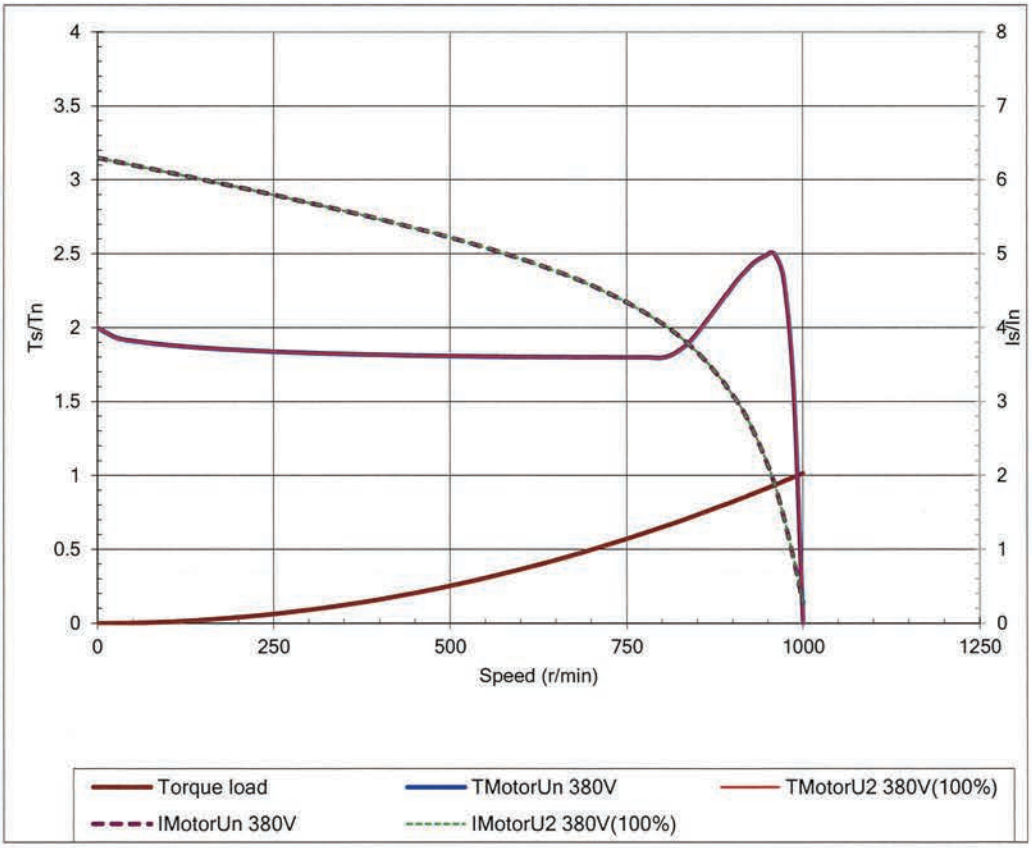
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Bangkok 10120 Tel: 02-665-1000
E-mail: Natthagorn.payhan@th.abb
Date: 10-May-24
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ข้อที่ 33.2

| IEC LV Motors | Starting Curves | | ABB |
|---|---|---|---|
| | Project | Location | |
| Department/Author<br>NP | Customer name | Customer ref | Item name<br>1.00001 |
| Our ref. | Rev/Changed b Date of issue<br>A 8/16/2023 | Saving ident<br>untitled.xlsm | Pages<br>3(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% | | | |

| | | | |
|---|---|---|---|
| $J_{motor}$ (kgm2) | 4.9 | Voltage (V) 100% | *380* |
| $J_{load}$ (kgm2) | | $T_{start}/T_N$ | *2* |
| Speed (r/min) | 993 | Starting time (s) | *0.4* |
| $T_N$ (Nm) | 721 | Speed (r/min) | *992* |
| $T_{load}$ (Nm) | 721 | $I_s/I_n$ | *6.3* |
| | | $T_{max}/T_n$ | *2.5* |




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

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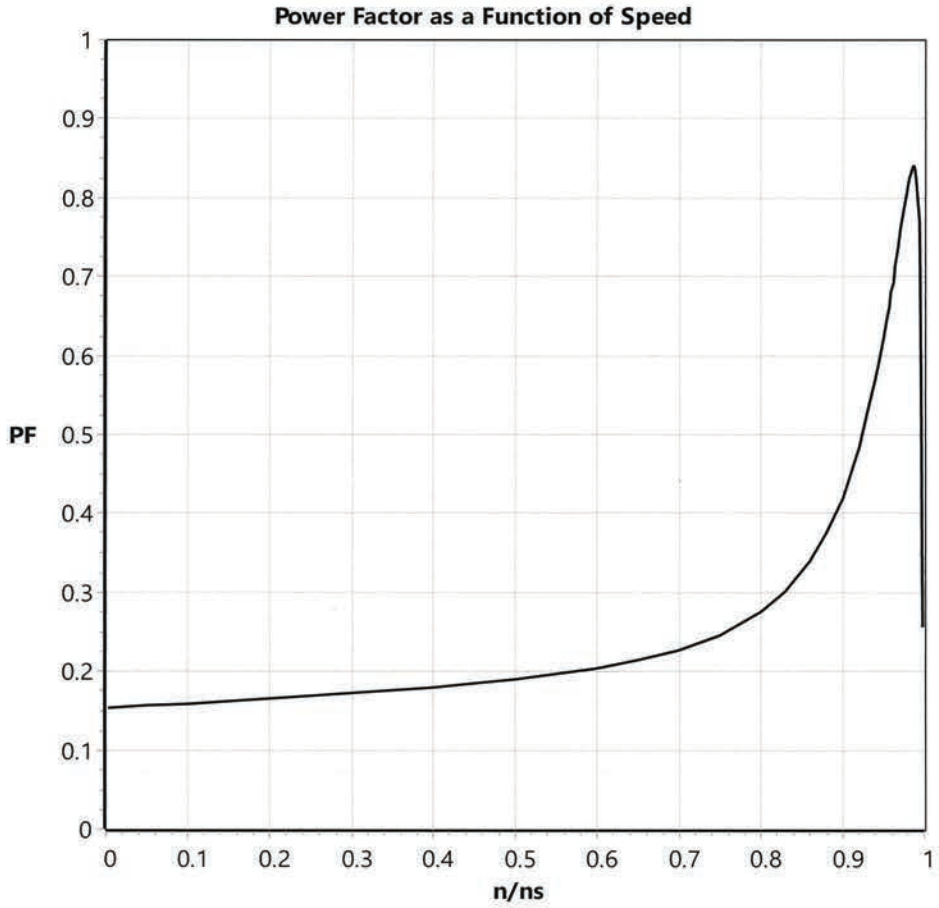
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ข้อที่ 33.2

| IEC LV Motors | Power Factor as a Function of Speed | | |
|---|---|---|---|
| | Project | Location | |
| Department/Author<br>NP | Customer name | Customer ref | Item name<br>1.00001 |
| Our ref. | Rev/Changed b Date of issue<br>A 8/16/2023 | Saving ident<br>untitled.xlsm | Pages<br>4(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% | | | |




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

All data subject to tolerances in accordance with IEC

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วิศวกรเครื่องกล สก.๒๙๗๐
โทร. ๐๘๑-๔๔๔-๔๖๖๗

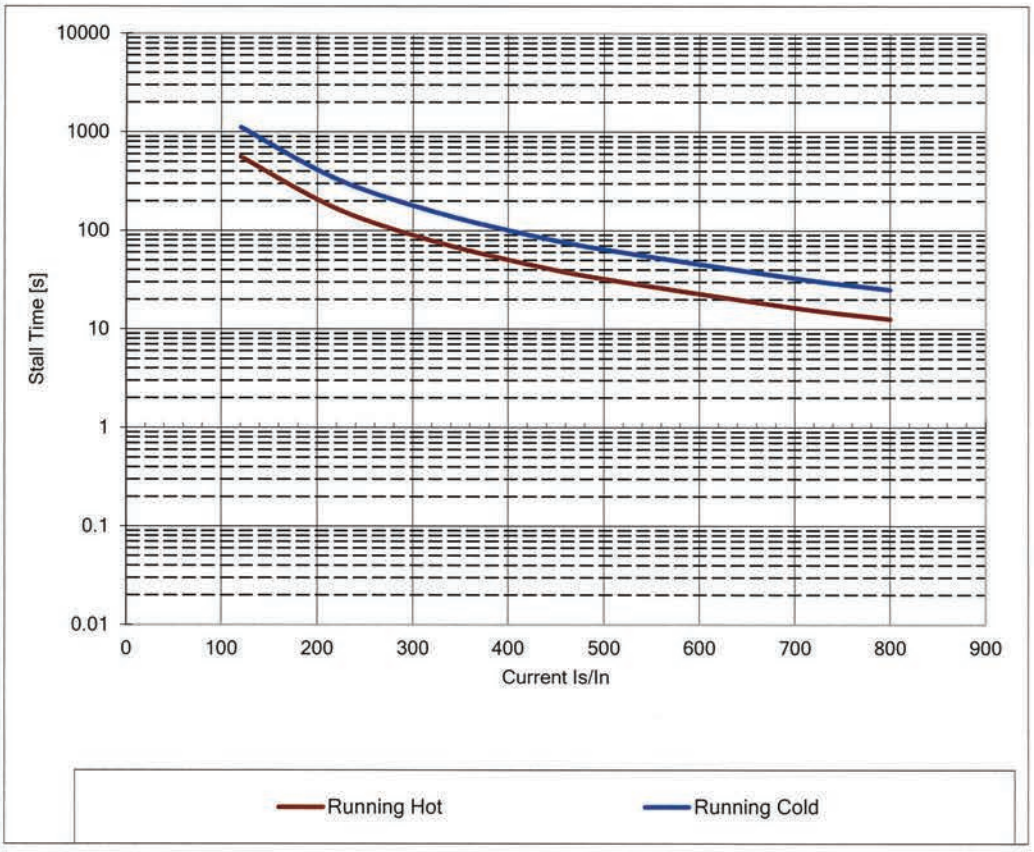
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ข้อที่ 33.2

| IEC LV Motors | Thermal Withstand Curve | | ABB |
|---|---|---|---|
| | Project | Location | |
| Department/Author<br>NP | Customer name | Customer ref | Item name<br>1.00001 |
| Our ref. | Rev/Changed b Date of issue<br>A 8/16/2023 | Saving ident<br>untitled.xlsm | Pages<br>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% | | | | |

| | | | | | |
|---|---|---|---|---|---|
| $J_{motor}$ (kgm2) | 4.9 | Voltage (V) 100% | *380* | Voltage (V) | *380V(100%)* |
| $J_{load}$ (kgm2) | | $T_{start}/T_N$ | *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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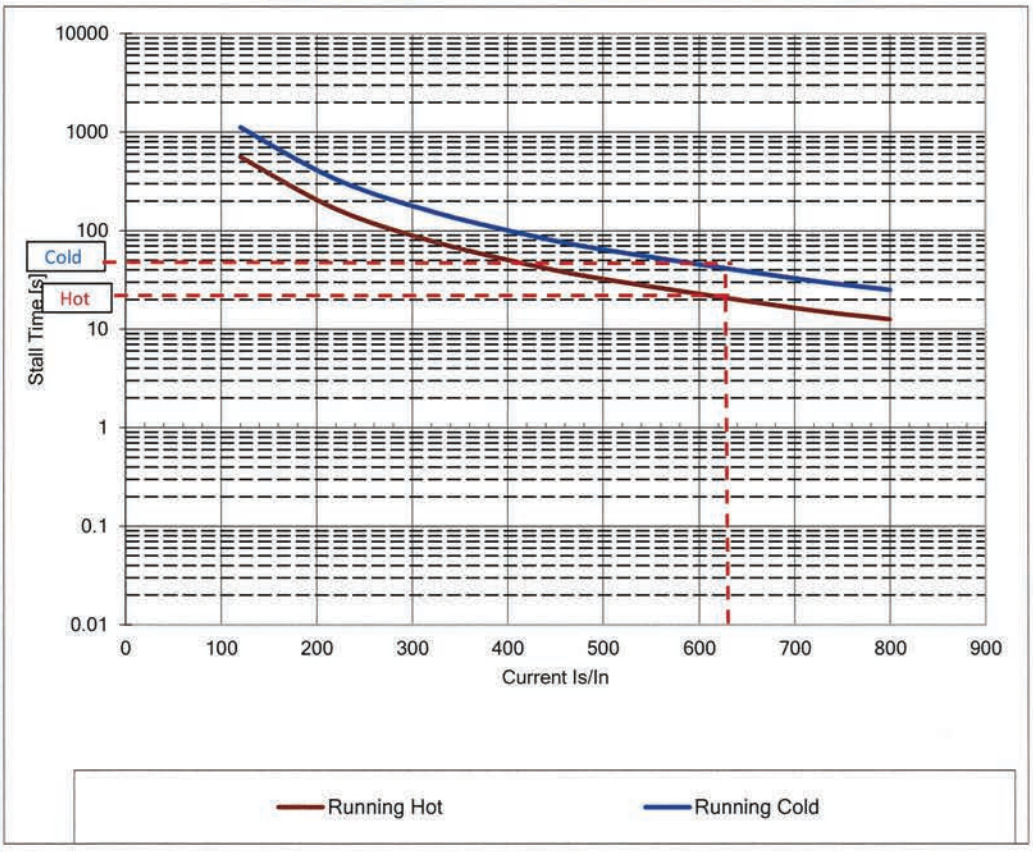
ข้อที่ 13.17, 33.2

| IEC LV Motors | Start cold and warm(hot) with Temperature Caculation | | ABB |
|---|---|---|---|
| | Project | Location | |
| Department/Author<br>NP | Customer name | Customer ref | Item name<br>1.00001 |
| Our ref. | Rev/Changed b Date of issue<br>A 8/16/2023 | Saving ident<br>untitled.xlsm | Pages<br>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***




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

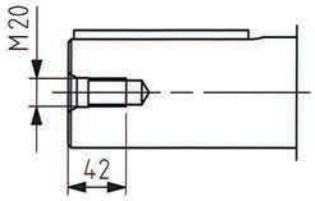
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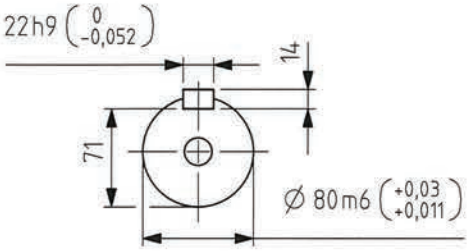
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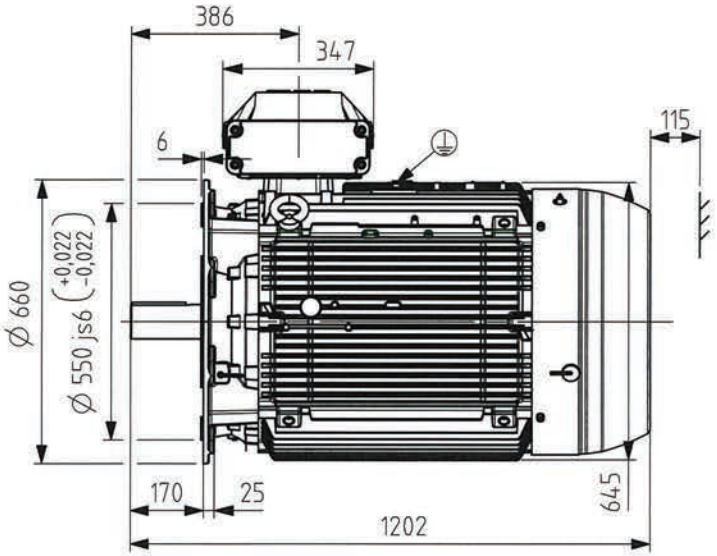
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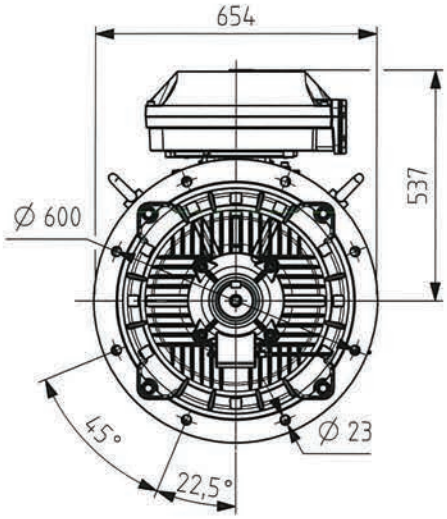
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ข้อที่ 33.2




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วิศวกรเครื่องกล สก.๒๙๗๐
โทร. ๐๘๑-๔๔๔-๔๖๖๗

GREEN TECHNOLOGY ASIA Co.,Ltd

| | | |
|---|---|---|
| **Dimension Print** | Motor type:<br>M3BP315 (G/K/L/M) SM_4-12; B5, V1, V3<br><br>M3GP/HP315 (G/K/L/M) SM_4-12; B5, V3 | Document No:<br>3GZF500031-3622 C |

Description:
STANDARD SQUIRREL CAGE MOTOR WITH TERMINAL BOX 370

| | | |
|---|---|---|
| Unit: Motors and Generators<br>Date: 24-Jun-2019 | Issued by: Penjala, Iikka<br>Approved by: Härmänmaa, Arttu | Replaces:<br>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

TÜVNORD
TÜV NORD CERT GmbH
ISO 9001
tuev-nord.de

# VERTICAL PUMPS

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

# INSTRUCTION MANUAL

***Gruppo Aturia S.p.A.***

*20060 Gessate (MILANO), ITALY / Piazza Aturia, 9*
*Tel. +39-0295423200 /Fax +39-0295423202*
*www.gruppoaturia.com*

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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.

**Please**note 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.

# 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**)

### 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.

# 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:

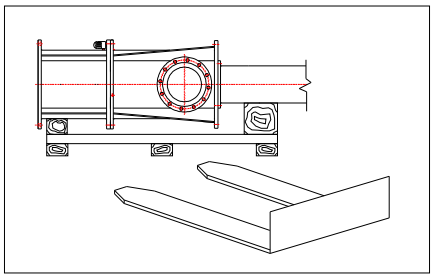
A on single pallet

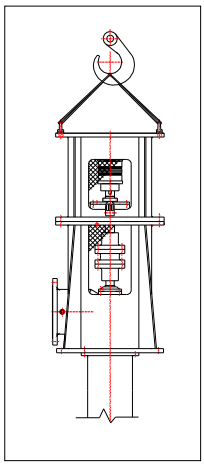
B in wooden case

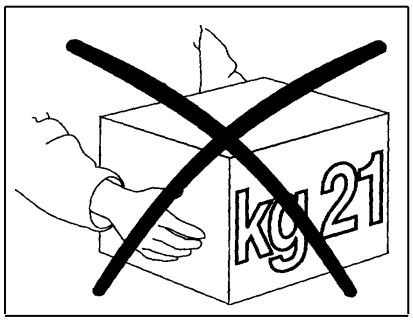
**ATTENTION!**

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.







## 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.

**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.

# 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

# 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 .

### 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.

# 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!**

# 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).

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**).

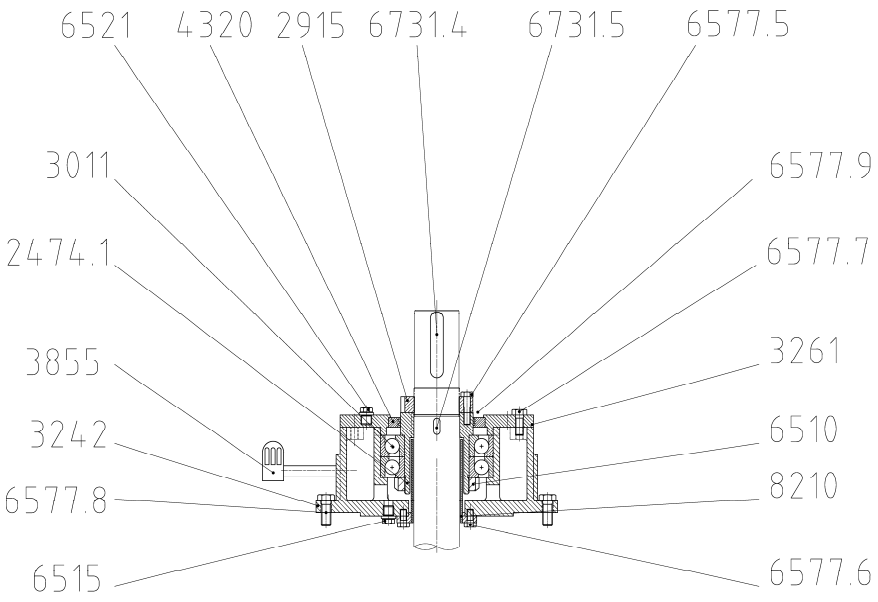
Removing the motor

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**)**.**

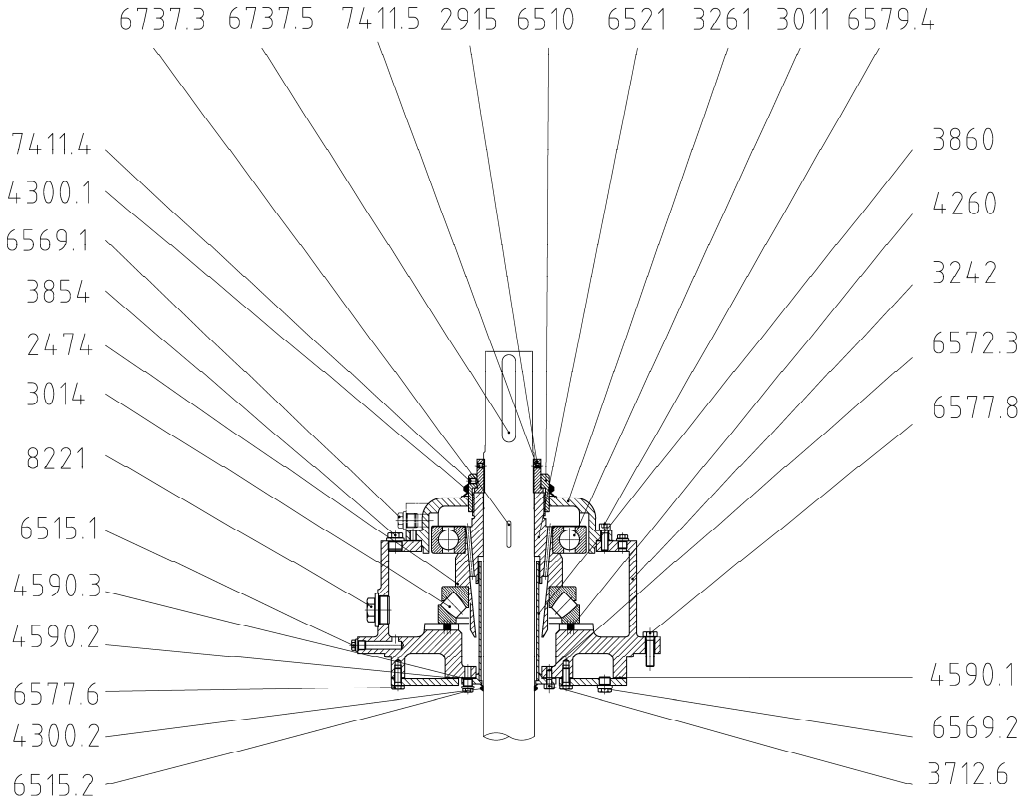
Removing the motor

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**)**.**



### 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

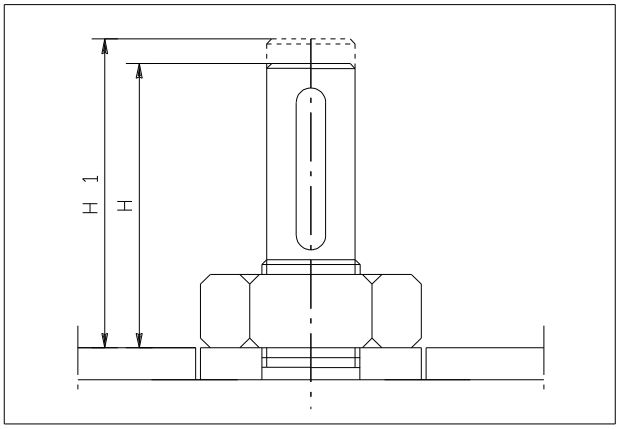
## REMOVAL

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.

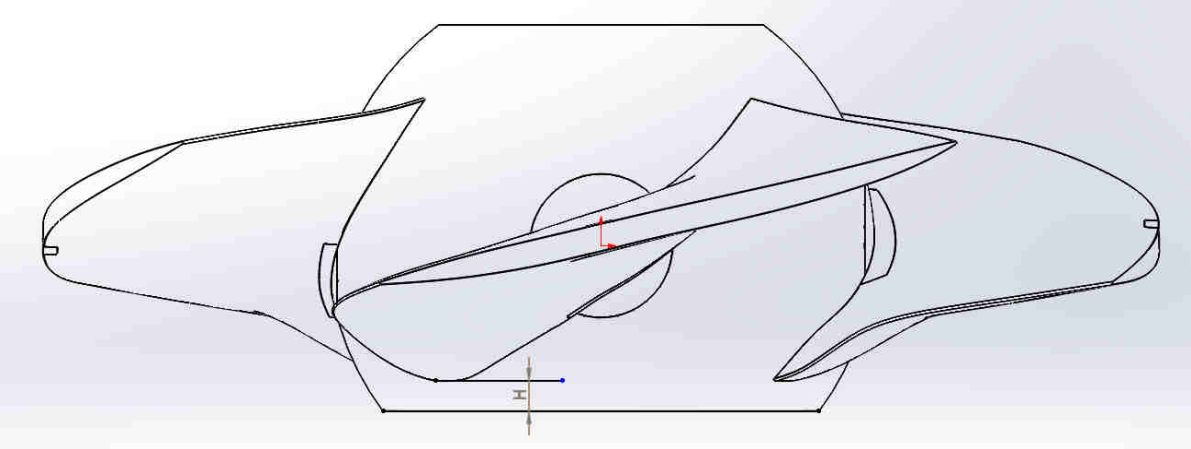
## ADJUSTMENT OF IMPELLER POSITION

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 halfon the shaft**.**



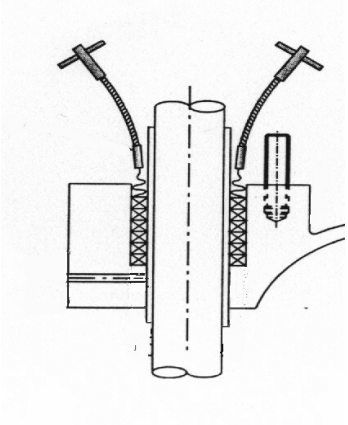
## ADJUSTMENT OF BLADE INCLINATION

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).

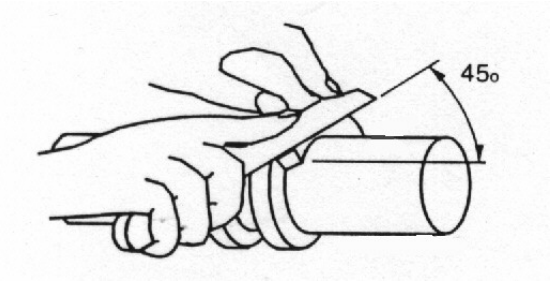
9.2 - DISASSEMBLING

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.



# 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 |

# 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.

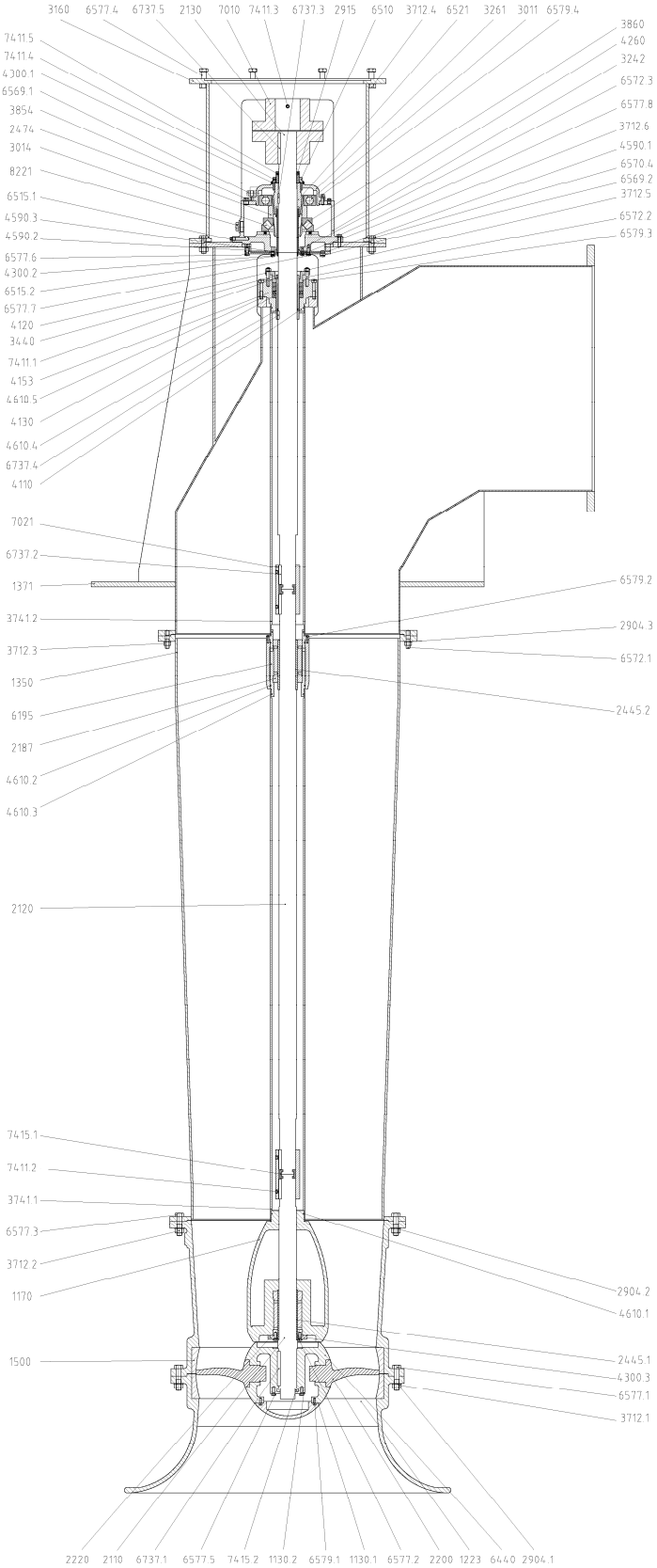
harmful or dangerous.

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.


3160
6577.4
6737.5
2130
7010
7411.3
6737.3
2915
6510
3712.4
6521
3261
3011
6579.4
7411.5
7411.4
4300.1
6569.1
3854
2474
3014
8221
6515.1
4590.3
4590.2
6577.6
4300.2
6515.2
6577.7
4120
3440
7411.1
4153
4610.5
4130
4610.4
6737.4
4110
3860
4260
3242
6572.3
6577.8
3712.6
4590.1
6570.4
6569.2
3712.5
6572.2
6579.3
7021
6737.2
1371
3741.2
3712.3
1350
6195
2187
4610.2
4610.3
6579.2
2904.3
6572.1
2445.2
2120
7415.1
7411.2
3741.1
6577.3
3712.2
1170
1500
2904.2
4610.1
2445.1
4300.3
6577.1
3712.1
2220
2110
6737.1
6577.5
7415.2
1130.2
6579.1
1130.1
6577.2
2200
1223
6440
2904.1

| 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 | | |

# 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** **MACHINE DESCRIPTION**
*Section 1* *Machinery Description*

Manufacturer / *Manufacturer*: GRUPPO ATURIA S.P.A.

Type: **PEN**

Model: **ELV-500S**

Description / *Description*: **Vertical axial pump** / *Axial vertical pump*

**Section 2** **APPLICABLE STANDARDS / DIRECTIVES**
*Section 2* *Applicable Directives / Standards*

Machinery Directive 98/37/CE
*Machinery Directive 98/37/EC*

**Section 3** **APPLICABLE SPECIFICATIONS AND STANDARDS**
*Section 3* *Applicable standards / Specifications*

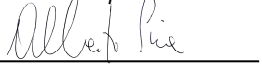
European Standard EN 809 - EN 292
*European Standard EN 809 – 292*

**Section 4** **DECLARATION**
*Section 4* *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

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# Instruction Manual

# For Motors

TÜVNORD
TÜV NORD CERT GmbH
ISO 9001
tuev-nord.de

# Low voltage motors
# Installation, operation, maintenance and safety manual



Installation, operation, maintenance and safety manual ..... EN 3

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# 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 °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<br>Weight kg | Cast iron<br>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.

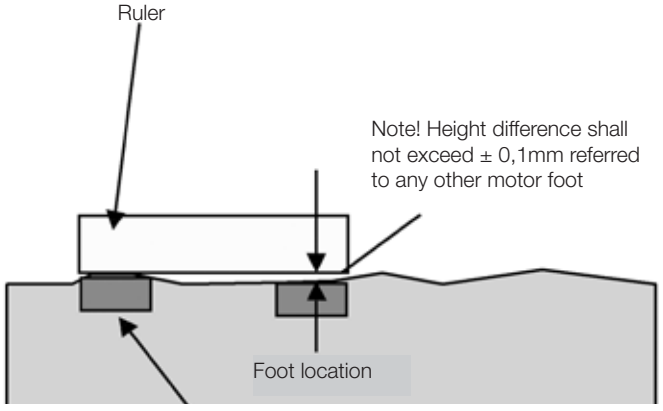
## 4.4 Foundation

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 ½ 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 mm$^2$.

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 °C to +40 °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 ±5 %, and for frequency ±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 kW** | **$P_N \geq$ 100 kW or IEC315 ≤ Frame size ≤ IEC355** | **$P_N \geq$ 350 kW or IEC400 ≤ Frame size ≤ IEC450** |
|---|---|---|---|
| $U_N \leq$ 500 V | Standard motor | Standard motor<br>+ Insulated N-bearing | Standard motor<br>+ Insulated N-bearing<br>+ Common mode filter |
| 500V > $U_N \leq$ 600V | Standard motor<br>+ dU/dt –filter (reactor)<br>OR<br>Reinforced insulation | Standard motor<br>+ dU/dt –filter (reactor)<br>+ Insulated N-bearing<br>OR<br>Reinforced insulation<br>+ Insulated N-bearing | Standard motor<br>+ Insulated N-bearing<br>+ dU/dt –filter (reactor)<br>+ Common mode filter<br>OR<br>Reinforced insulation<br>+ Insulated N-bearing<br>+ Common mode filter |
| 500V > $U_N \leq$ 600V<br>(cable length > 150 m) | Standard motor | Standard motor<br>+ Insulated N-bearing | Standard motor<br>+ Insulated N-bearing<br>+ Common mode filter |
| 600V > $U_N \leq$ 690V | Reinforced insulation<br>+ dU/dt –filter (reactor) | Reinforced insulation<br>+ dU/dt –filter (reactor)<br>+ Insulated N-bearing | Reinforced insulation<br>+ Insulated N-bearing<br>+ dU/dt –filter (reactor)<br>+ Common mode filter |
| 600V > $U_N \leq$ 690V<br>(cable length > 150 m) | Reinforced insulation | Reinforced insulation<br>+ Insulated N-bearing | Reinforced insulation<br>+ Insulated N-bearing<br>+ 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 g/7600 h*3*24 = 0,52 g/day

(NDE) RLI = 40 g/7600 h*3*24 = 0,38 g/day

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

(DE) RLI = 55 g/7600 h*24 = 0,17 g/day

(NDE) RLI = 40 g/7600 h*24 = 0,13 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 | 12000 | ≤ 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 Dm x n where Dm = 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.

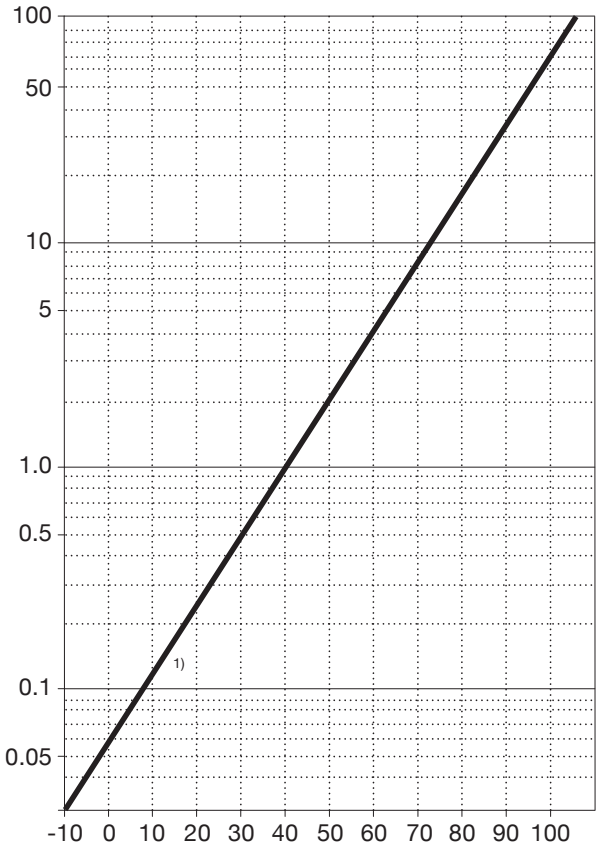
## Motor troubleshooting chart

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.<br>Check bearings and lubrication. |
| | Short circuited stator | Contact ABB<br>or<br>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.<br>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.<br>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 $k_{tc}$. $R_{i\ 40\ °C} = R_i$ x

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.

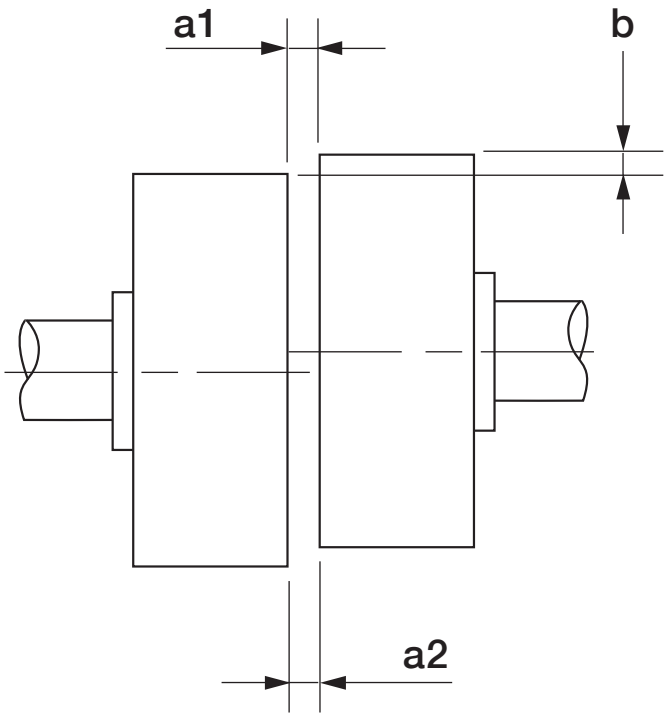



Figure 2. Mounting of half-coupling or pulley

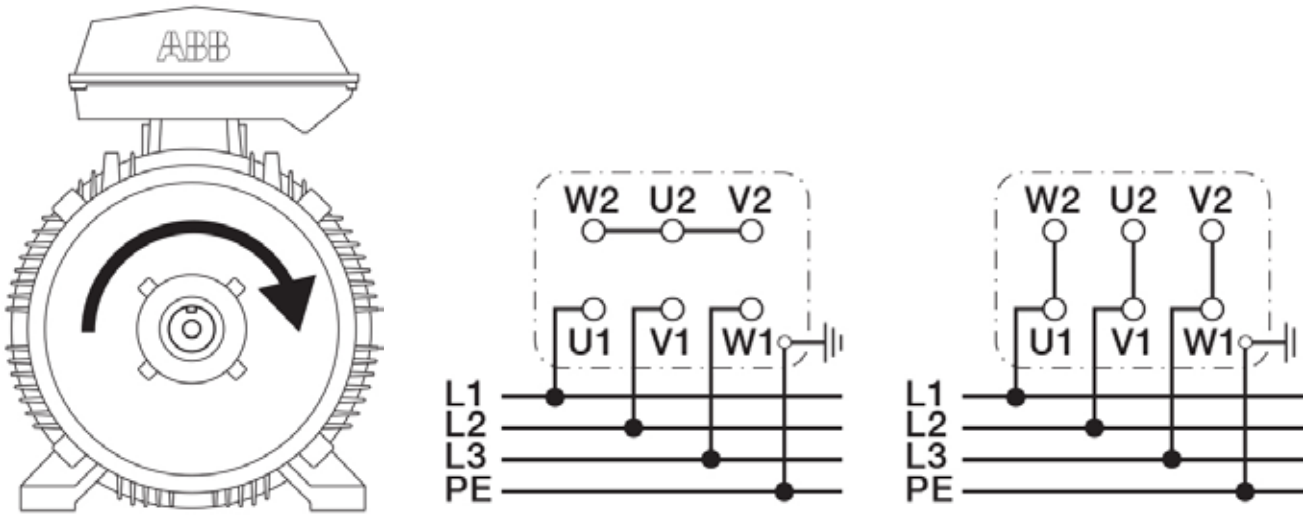
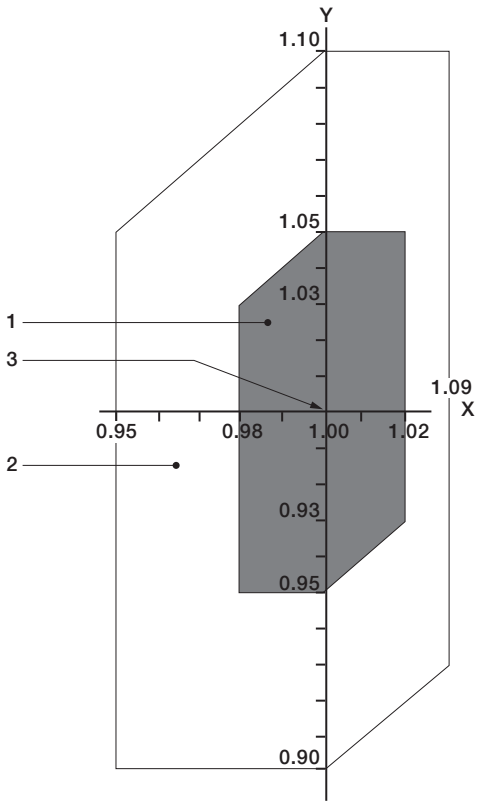



Figure 3. Connection of terminals for main supply

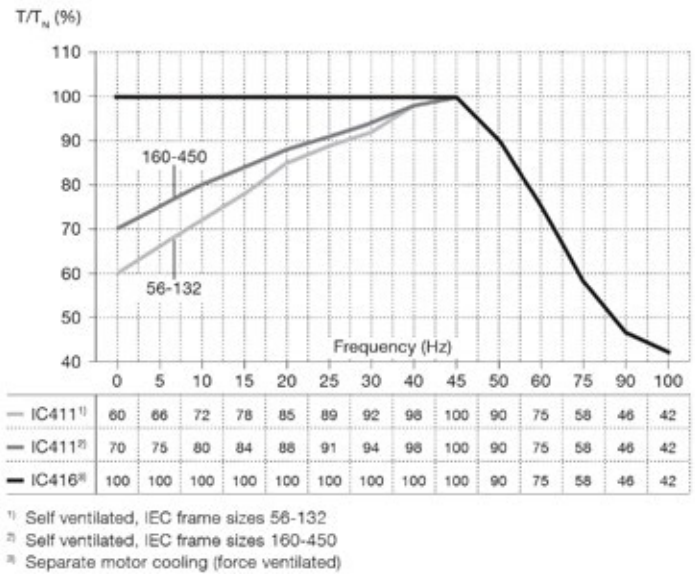



**Key**

| | |
|---|---|
| X axis | frequency p.u. |
| Y axis | voltage p.u. |
| 1 | zone A |
| 2 | zone B (outside zone A) |
| 3 | rating point |

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

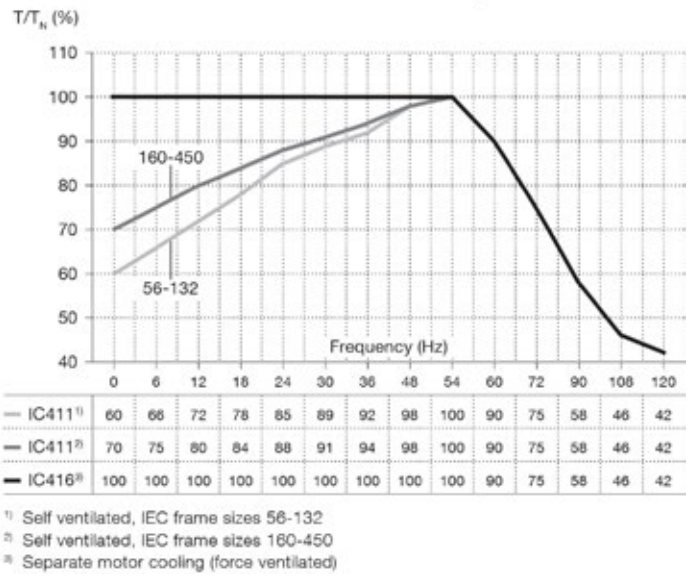
## Guideline loadability curves with converters with DTC control




| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (Hz) | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 45 | 50 | 60 | 75 | 90 | 100 |
| IC411[1] | 60 | 66 | 72 | 78 | 85 | 89 | 92 | 98 | 100 | 90 | 75 | 58 | 46 | 42 |
| IC411[2] | 70 | 75 | 80 | 84 | 88 | 91 | 94 | 98 | 100 | 90 | 75 | 58 | 46 | 42 |
| IC416[3] | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 90 | 75 | 58 | 46 | 42 |

[1] Self ventilated, IEC frame sizes 56-132
[2] Self ventilated, IEC frame sizes 160-450
[3] Separate motor cooling (force ventilated)

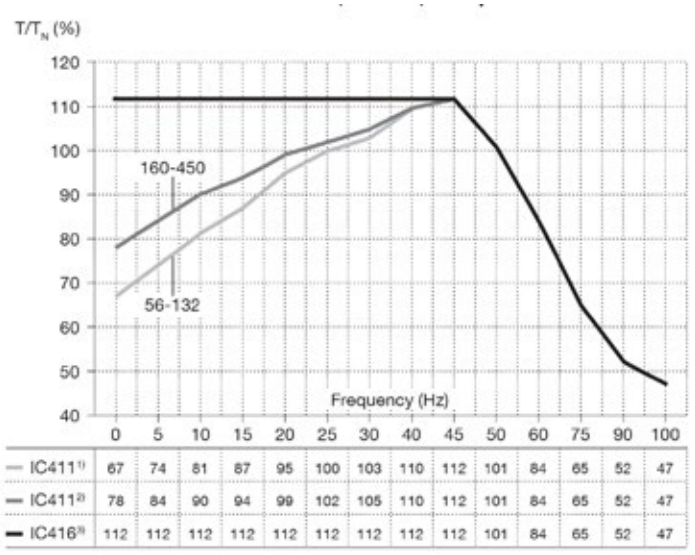
Figure 5a. Conventer with DTC control, 50 Hz, temperature rise B




| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (Hz) | 0 | 6 | 12 | 18 | 24 | 30 | 36 | 48 | 54 | 60 | 72 | 90 | 108 | 120 |
| IC411[1] | 60 | 66 | 72 | 78 | 85 | 89 | 92 | 98 | 100 | 90 | 75 | 58 | 46 | 42 |
| IC411[2] | 70 | 75 | 80 | 84 | 88 | 91 | 94 | 98 | 100 | 90 | 75 | 58 | 46 | 42 |
| IC416[3] | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 90 | 75 | 58 | 46 | 42 |

[1] Self ventilated, IEC frame sizes 56-132
[2] Self ventilated, IEC frame sizes 160-450
[3] Separate motor cooling (force ventilated)

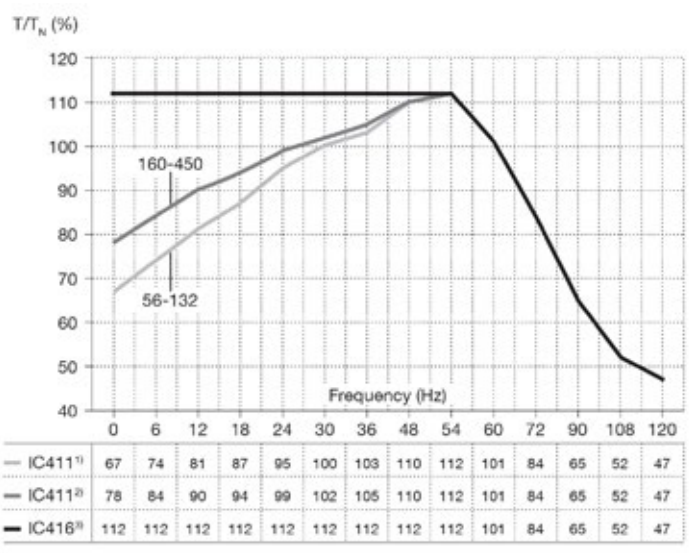
Figure 5b. Conventer with DTC control, 60 Hz, temperature rise B




| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (Hz) | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 40 | 45 | 50 | 60 | 75 | 90 | 100 |
| IC411[1] | 67 | 74 | 81 | 87 | 95 | 100 | 103 | 110 | 112 | 101 | 84 | 65 | 52 | 47 |
| IC411[2] | 78 | 84 | 90 | 94 | 99 | 102 | 105 | 110 | 112 | 101 | 84 | 65 | 52 | 47 |
| IC416[3] | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 101 | 84 | 65 | 52 | 47 |

[1] Self ventilated, IEC frame sizes 56-132
[2] Self ventilated, IEC frame sizes 160-450
[3] Separate motor cooling (force ventilated)

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

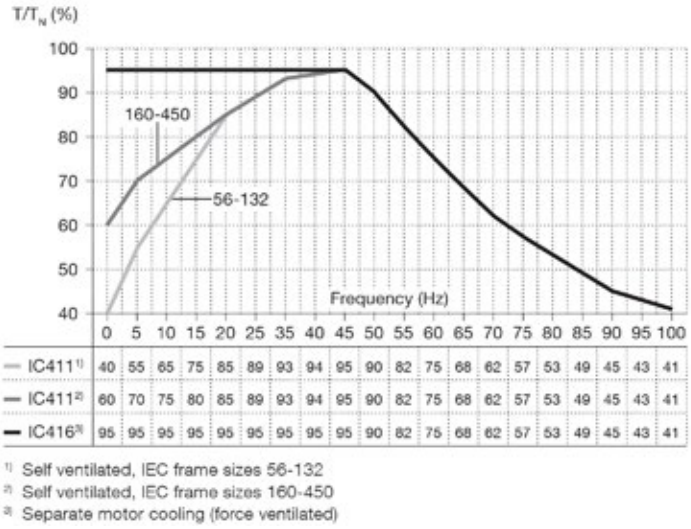



| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (Hz) | 0 | 6 | 12 | 18 | 24 | 30 | 36 | 48 | 54 | 60 | 72 | 90 | 108 | 120 |
| IC411[1] | 67 | 74 | 81 | 87 | 95 | 100 | 103 | 110 | 112 | 101 | 84 | 65 | 52 | 47 |
| IC411[2] | 78 | 84 | 90 | 94 | 99 | 102 | 105 | 110 | 112 | 101 | 84 | 65 | 52 | 47 |
| IC416[3] | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 112 | 101 | 84 | 65 | 52 | 47 |

[1] Self ventilated, IEC frame sizes 56-132
[2] Self ventilated, IEC frame sizes 160-450
[3] Separate motor cooling (force ventilated)

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

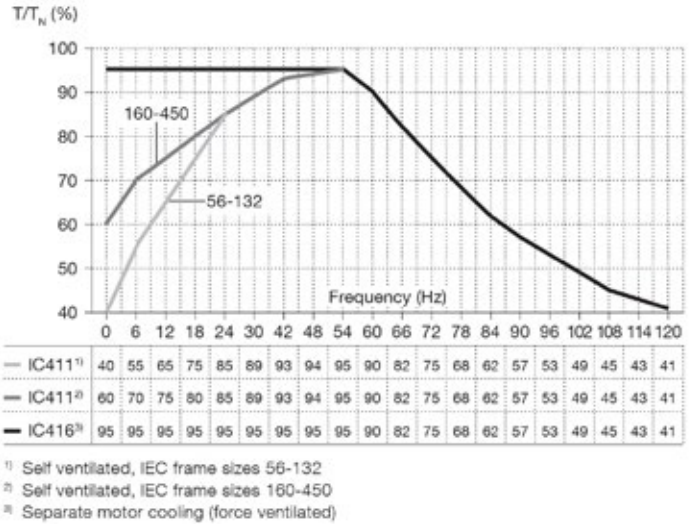
## Guideline loadability curves with other voltage source PWM type




| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (Hz) | 0 | 5 | 10 | 15 | 20 | 25 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |
| IC411[1] | 40 | 55 | 65 | 75 | 85 | 89 | 93 | 94 | 95 | 90 | 82 | 75 | 68 | 62 | 57 | 53 | 49 | 45 | 43 | 41 |
| IC411[2] | 60 | 70 | 75 | 80 | 85 | 89 | 93 | 94 | 95 | 90 | 82 | 75 | 68 | 62 | 57 | 53 | 49 | 45 | 43 | 41 |
| IC416[3] | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 90 | 82 | 75 | 68 | 62 | 57 | 53 | 49 | 45 | 43 | 41 |

[1] Self ventilated, IEC frame sizes 56-132
[2] Self ventilated, IEC frame sizes 160-450
[3] Separate motor cooling (force ventilated)

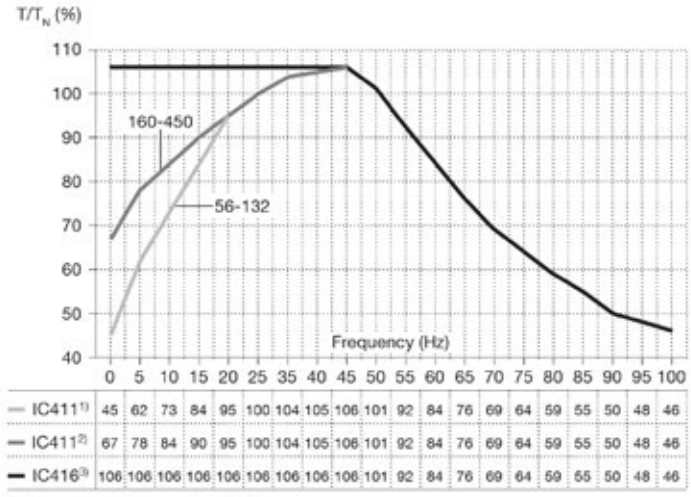
Figure 6a. Other voltage source PWM type converter, 50 Hz, temperature rise B




| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (Hz) | 0 | 6 | 12 | 18 | 24 | 30 | 42 | 48 | 54 | 60 | 66 | 72 | 78 | 84 | 90 | 96 | 102 | 108 | 114 | 120 |
| IC411[1] | 40 | 55 | 65 | 75 | 85 | 89 | 93 | 94 | 95 | 90 | 82 | 75 | 68 | 62 | 57 | 53 | 49 | 45 | 43 | 41 |
| IC411[2] | 60 | 70 | 75 | 80 | 85 | 89 | 93 | 94 | 95 | 90 | 82 | 75 | 68 | 62 | 57 | 53 | 49 | 45 | 43 | 41 |
| IC416[3] | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 90 | 82 | 75 | 68 | 62 | 57 | 53 | 49 | 45 | 43 | 41 |

[1] Self ventilated, IEC frame sizes 56-132
[2] Self ventilated, IEC frame sizes 160-450
[3] Separate motor cooling (force ventilated)

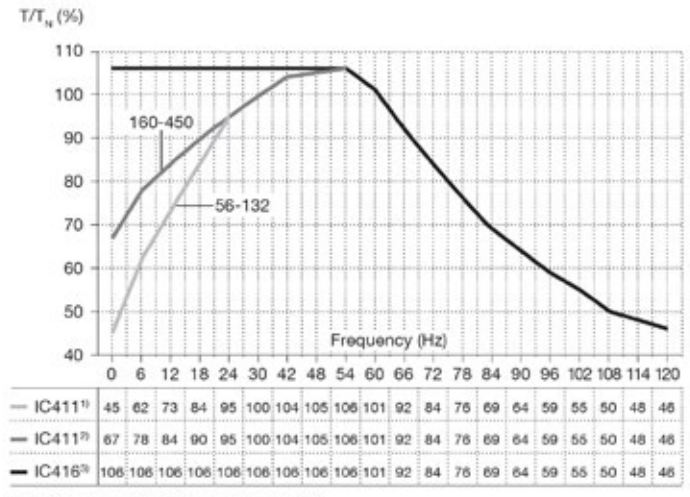
Figure 6b. Other voltage source PWM type converter, 60 Hz, temperature rise B




| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (Hz) | 0 | 5 | 10 | 15 | 20 | 25 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |
| IC411[1] | 45 | 62 | 73 | 84 | 95 | 100 | 104 | 105 | 106 | 101 | 92 | 84 | 76 | 69 | 64 | 59 | 55 | 50 | 48 | 46 |
| IC411[2] | 67 | 78 | 84 | 90 | 95 | 100 | 104 | 105 | 106 | 101 | 92 | 84 | 76 | 69 | 64 | 59 | 55 | 50 | 48 | 46 |
| IC416[3] | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 101 | 92 | 84 | 76 | 69 | 64 | 59 | 55 | 50 | 48 | 46 |

[1] Self ventilated, IEC frame sizes 56-132
[2] Self ventilated, IEC frame sizes 160-450
[3] Separate cooling (force ventilated)

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




| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (Hz) | 0 | 6 | 12 | 18 | 24 | 30 | 42 | 48 | 54 | 60 | 66 | 72 | 78 | 84 | 90 | 96 | 102 | 108 | 114 | 120 |
| IC411[1] | 45 | 62 | 73 | 84 | 95 | 100 | 104 | 105 | 106 | 101 | 92 | 84 | 76 | 69 | 64 | 59 | 55 | 50 | 48 | 46 |
| IC411[2] | 67 | 78 | 84 | 90 | 95 | 100 | 104 | 105 | 106 | 101 | 92 | 84 | 76 | 69 | 64 | 59 | 55 | 50 | 48 | 46 |
| IC416[3] | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 101 | 92 | 84 | 76 | 69 | 64 | 59 | 55 | 50 | 48 | 46 |

[1] Self ventilated, IEC frame sizes 56-132
[2] Self ventilated, IEC frame sizes 160-450
[3] Separate motor cooling (force ventilated)

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

# Contact us

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3GZF500730-85 Rev G EN 07-2016

Power and productivity
for a better world™

**A.T.CRANE CO., LTD.**

**บริษัท เอ.ที.เครน จำกัด**

---

**Document Title**

# FINAL BOOK

**Specification, General Drawing,**
**Manual, , Catalogue, Certificate**

## Project

Electric Overhead Travelling Crane Single girder Cap. 5 Tons.
จัดหาและติดตั้งเครื่องสูบน้ำ ชนิดเพลาตั้ง และจัดหาและติดตั้งระบบผลิตไฟฟ้าพลังงานแสงอาทิตย์ สำหรับงานปรับปรุงสถานีสูบน้ำด้วยไฟฟ้า 5 สถานี โครงการส่งน้ำและบำรุงรักษาบางบาล ตำบลบ้านป้อม อำเภอพระนครศรีอยุธยา จังหวัดพระนครศรีอยุธยา
(สถานีสูบน้ำโรงสูบน้ำที่ 10)

**Client**
บริษัท กรีน เทคโนโลยี เอเซีย จำกัด

**A.T.CRANE CO., LTD.**

**บริษัท เอ.ที.เครน จำกัด**

---

**Document Title**

# SPECIFICATION

## Project

Electric Overhead Travelling Crane Single girder Cap. 5 Tons.

จัดหาและติดตั้งเครื่องสูบน้ำ ชนิดเพลาตั้ง และจัดหาและติดตั้งระบบผลิตไฟฟ้าพลังงานแสงอาทิตย์ สำหรับงานปรับปรุงสถานีสูบน้ำด้วยไฟฟ้า 5 สถานี โครงการส่งน้ำและบำรุงรักษาบางบาล ตำบลบ้านป้อม อำเภอพระนครศรีอยุธยา จังหวัดพระนครศรีอยุธยา

(สถานีสูบน้ำโรงสูบน้ำที่ 10)

**Client**

บริษัท กรีน เทคโนโลยี เอเซีย จำกัด

# ข้อมูลทางเทคนิค

**รายการที่ 1 เครนไฟฟ้าแบบคานเดี่ยว (Single girder) ขนาด 5 ตัน จำนวน 1 ชุด**

**รายการที่ 1.1 Crane Component**

" A.T.CRANE " รอกสลิงไฟฟ้า (มาตรฐานยุโรป) ← ข้อ1

| | | | |
|---|---|---|---|
| รุ่น | : | ATC-WS-5T-M5-9m | ← ข้อ2 |
| ขนาดรับน้ำหนัก | : | 5 ตัน | ← ข้อ7.2 |
| ระยะยกสูง | : | 9 เมตร | ← ข้อ7.3.1 |
| ความเร็วในการยก ( 2 สปีด ) | : | 5/0.8 เมตร/นาที 6.1/0.9 กิโลวัตต์ 60%ED | ← ข้อ7.6,7.6.1,7.6.2,7.6.3 |
| มอเตอร์ในการยกยี่ห้อ | : | SEW-EURODRIVE, German brand | |
| ความเร็วในการเคลื่อนที่ ซ้าย-ขวา ( อินเวอร์เตอร์ ) | : | 5-->20 เมตร/นาที 0.37 กิโลวัตต์ 100%ED | ← ข้อ7.7,7.7.1,7.7.2,7.7.3 |
| มอเตอร์ในการเคลื่อนที่ ซ้าย-ขวา ยี่ห้อ | : | SEW-EURODRIVE, German brand | |
| FEM Group | : | 2m/M5 | ← ข้อ9 |
| ประสิทธิภาพมอเตอร์ | : | IP55, Class F | ← ข้อ8 |
| จำนวนทบสลิง | : | สลิง 1 เส้น 4 ทบ | |
| สลิงยี่ห้อ | : | Bridon, UK brand | |
| สวิทช์ปุ่มกด ปุ่มกดควบคุม | : | ปุ่มกดควบคุมแบบติดกับตัวรอก 6 ปุ่มพร้อมปุ่มปิดฉุกเฉิน | ← ข้อ12.5 |
| แรงเคลื่อนไฟฟ้าในการทำงาน | : | 380 โวลท์ 3 เฟส 50 เฮิร์ท | ← ข้อ11 |
| แรงเคลื่อนไฟฟ้าในการควบคุม | : | 48 โวลท์ | |

**อุปกรณ์ระบบความปลอดภัยมาตรฐานยุโรป**

- หน้าจอแสดงน้ำหนักภายในตู้คอนโทรลของรอก ไม่มีหน้าจอแสดงผลแยก (Overload Displayer) ← ข้อ12.1
- ลิมิตสวิทช์ (4 จังหวะ) ตัดการทำงานเมื่อตะขอขึ้นตำแหน่งสูงสุด และลงต่ำสุด ← ข้อ12.4
- อุปกรณ์ตัดการทำงานเมื่อยกน้ำหนักเกินพิกัด (Overload Protection)
- อุปกรณ์ตัดการทำงานของมอเตอร์ เมื่ออุณหภูมิสูงเกินพิกัดและอุปกรณ์ป้องกันระบบไฟฟ้า (Thermal Protection) ← ข้อ12.2
- อุปกรณ์ป้องกันแรงดันไฟตก ไฟเกิน และแรงดันไม่ครบเฟส (Phase Protection) ← ข้อ12.3




นายศิลปชัย เพิ่มพูล
สามัญวิศวกรเครื่องกล
สก.3393



A.T.CRANE CO., LTD.
123/101 Fifth Avenue Ladkrabang, Chalong Krung Road, Lamplathew, Ladkrabang, Bangkok 10520
LINE: @a.t.crane Tel.: 02-130-0834 Mobile: 063-661-9998 E-mail: info@atcrane.co.th www.atcrane.co.th

ชุดล้อขับเคลื่อนเครนตามยาว



| | | |
|---|---|---|
| รุ่น | : | ETN11-1755 |
| ขนาดล้อโต | : | 110 มิลลิเมตร |
| จำนวนล้อ | : | 4 ล้อ |
| ระยะห่างระหว่างล้อ | : | 1700 มิลลิเมตร |
| FEM Group | : | 2m/M5 |
| ประสิทธิภาพมอเตอร์ | : | IP55, Class F |
| ความเร็วในการเคลื่อนที่ตามยาว (อินเวอร์เตอร์) | : | 5-->20 เมตร/นาที 2 x 0.37 กิโลวัตต์ ← ข้อ7.8,7.8.1,7.8.2,7.8.3 |

ตู้คอนโทรลเครนตามยาว

| | | |
|---|---|---|
| รุ่น | : | TELEPANELP3 (ควบคุมด้วยระบบอินเวอร์เตอร์) |
| ควบคุมความเร็วยกขึ้น/ลง | : | 2 สปีด |
| ควบคุมความเร็วตามขวาง | : | อินเวอร์เตอร์ |
| ควบคุมความเร็วตามยาว | : | อินเวอร์เตอร์ |

พร้อมอุปกรณ์ป้องกันแรงดันไฟตก ไฟเกิน และแรงดันไม่ครบเฟส

**ITEM 1.2 ระบบไฟฟ้าเครนตามขวาง**



ระบบไฟฟ้าควบคุมเครน ซ้าย – ขวา

| | | |
|---|---|---|
| ความกว้าง ( กล่องเครน ) | : | 5 เมตร ← ข้อ7.3.2 |
| ชนิดสายไฟ | : | สายไฟแบนพร้อมราง C-Rail (flat cable, c-rails, trolleys) |

ระบบไฟฟ้าเครนวิ่งตามยาว



| | | |
|---|---|---|
| เหล็กทางวิ่งยาว | : | 7 เมตร ← ข้อ7.3.4 |
| ชนิดสายไฟ | : | High Tro Reel 4 Pole 50 Amp. |

**Special Free Offer**

ข้อ12.7.2

- Remote Control ไร้สาย รุ่น TR1-8D (Tele) 2 Speeds 1 ชุด
- สัญญาณแสงและเสียงเตือนขณะเคลื่อนที่ทุกทิศทาง
- ลิมิตสวิทช์ ( 2 จังหวะ ) ตัดการทำงานสำหรับการเคลื่อนที่ตามแนวขวาง
- ลิมิตสวิทช์ ( 2 จังหวะ ) ตัดการทำงานสำหรับการเคลื่อนที่ตามแนวยาว

ข้อ12.6

A.T. CRANE CO.,LTD. บริษัท เอ.ที. เครน จำกัด
นายศิลปชัย เพิ่มพูล
สามัญวิศวกรเครื่องกล
ยก.3393

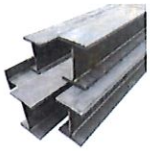
**รายการที่ 1.3 Steel Structure Work**

เหล็กโครงสร้างสะพานกลางเครน

| | | |
|---|---|---|
| ลักษณะกล่องเครน (Girder) | : | เครนแบบคานเดี่ยว (Single Girder) |
| ความกว้าง | : | 5 เมตร |
| ความโก่งของสะพานเครน (Deflection) | : | L/1000 ← ข้อ7.1 |
| มาตรฐาน | : | FEM/ DIN/ BS |

เหล็กรางเครนและเหล็กรองรับรางเครน

| | | |
|---|---|---|
| เหล็กทางวิ่งยาว | : | 2 x 7 เมตร ← ข้อ7.3.4 |
| ขนาดเหล็กรางวิ่ง (Runway Rail) | : | Sq.bar 38 x 38 มิลลิเมตร ( 2 x 7 เมตร ) ← ข้อ7.5 |
| ขนาดเหล็กรองรางวิ่งเครน (Runway Beam) | : | WF 250 x 125 x 6 x 9 mm. ( 2 x 7 เมตร ) |
| Deflection Design | : | L/500 ← ข้อ7.4 |
| ระยะห่างระหว่างเสา ( C - C ) | : | 3.5 เมตร ← ข้อ7.3.3 |





บันไดสำหรับซ่อมบำรุงเครน พร้อม Base Plate & Bolts ← ข้อ12.7.3

***หมายเหตุ : กรณีที่มีการปรับเปลี่ยนขนาดเหล็กรองรางวิ่งเครน(Runway Beam) จะต้องมีค่าใช้จ่ายเพิ่มเติม

**Facilites**

- CNC Plasma cutting machine
- Fabrication Floors
- Welding Machines (Electric welding machine, Flux core welding machine)
- Hydraulic shearing machine
- Span Aligning Bench
- Painting Shop

A.T. CRANE CO.,LTD. บริษัท เอ.ที. เครน จำกัด
นายศิลปชัย เพิ่มพูล
สามัญวิศวกรเครื่องกล
สก.3393







การติดตั้ง และการขนส่ง

- ขนส่งอุปกรณ์ทั้งหมดจากโรงงานเอ.ที.เครนไปยังสถานที่ติดตั้ง
- การติดตั้งจะใช้รถเครนซึ่งทางบริษัทฯจะเป็นผู้จัดเตรียมให้ โดยผู้ซื้อจะต้องจัดเตรียมสถานที่เพื่อความสะดวกในการติดตั้ง
- ติดตั้งรางวิ่งเครนและสะพานกลางเครนโดยลูกค้าจะต้องจัดหาไฟฟ้าให้เพียงพอสำหรับการเชื่อม
- ตกแต่งสีเครนในกรณีที่เกิดความเสียหายจากการติดตั้ง
- การทดสอบและส่งมอบงานพร้อมออกเอกสาร ปจ.1 จำนวน 1 ครั้ง
- บริษัท เอ.ที.เครน จำกัด เป็นผู้จัดเตรียมก้อนน้ำหนักสำหรับทดสอบ จำนวน 1 ครั้ง

## ขอบเขตของผู้ขาย

| | |
|---|---|
| อุปกรณ์และเงื่อนไขที่จัดเตรียมและจัดทำโดยผู้ขาย | - รอกสลิงไฟฟ้าพร้อมปุ่มกดควบคุม ชุดล้อขับเคลื่อนเครนตามยาวพร้อมมอเตอร์ ตู้คอนโทรล<br>- ระบบไฟฟ้าเครนวิ่งตามขวาง<br>- ระบบไฟฟ้าเครนวิ่งตามยาว<br>- โครงสร้างเหล็ก (สะพานเครนแบบคานเดี่ยว เหล็กรางวิ่ง เหล็กรองรางวิ่ง บันไดสำหรับซ่อมบำรุง Base Plate & Bolts) ← ข้อ14.2<br>- การขนส่ง ติดตั้งเครน ระบบไฟฟ้า และทดสอบการทำงานของเครน<br>- ทดสอบน้ำหนักพร้อมออกเอกสารปจ. 1 จำนวน 1 ครั้ง<br>- ก้อนโหลดสำหรับทดสอบน้ำหนัก จำนวน 1 ครั้ง |

## ขอบเขตของผู้ซื้อ ข้อ14.3

| | |
|---|---|
| อุปกรณ์และเงื่อนไขที่จัดเตรียมและจัดทำโดยผู้ซื้อ | - Main breaker และสายไฟจาก Main breaker ต่อถึงจุดป้อนไฟเข้าเครน<br>- โครงสร้างอาคาร และฐานรากทั้งหมด<br>- ไฟฟ้าสำหรับเชื่อมหน้างาน<br>- อุปกรณ์ต่างๆ ภายใต้ตะขอ<br>- อุปกรณ์อื่นๆ ซึ่งมิได้ระบุไว้ในข้อเสนอ |

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นายศิลปชัย เพิ่มพูล
สามัญวิศวกรเครื่องกล
สก.3393

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---

**Document Title**

# GENERAL DRAWING

## Project

Electric Overhead Travelling Crane Single girder Cap. 5 Tons.

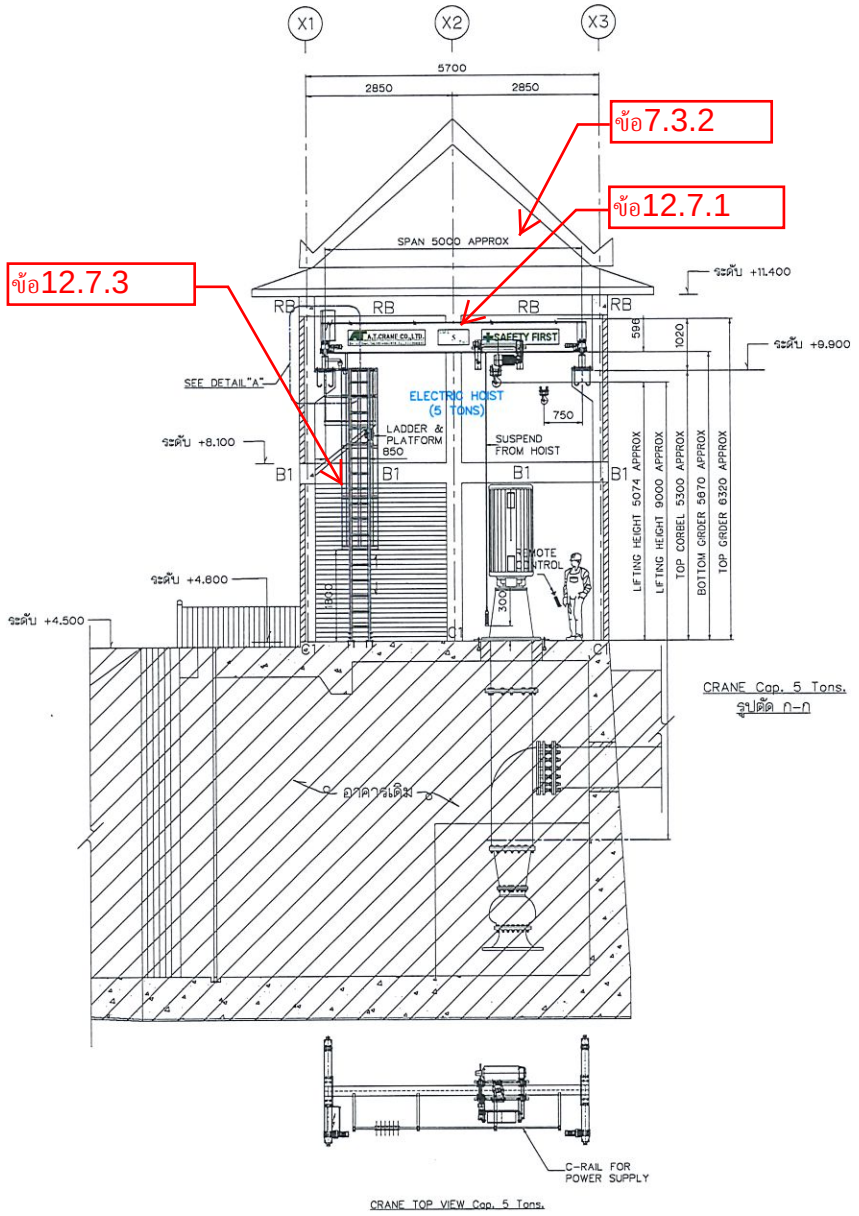
จัดหาและติดตั้งเครื่องสูบน้ำ ชนิดเพลาตั้ง และจัดหาและติดตั้งระบบผลิตไฟฟ้าพลังงานแสงอาทิตย์ สำหรับงานปรับปรุงสถานีสูบน้ำด้วยไฟฟ้า 5 สถานี โครงการส่งน้ำและบำรุงรักษาบางบาล ตำบลบ้านป้อม อำเภอพระนครศรีอยุธยา จังหวัดพระนครศรีอยุธยา

(สถานีสูบน้ำโรงสูบน้ำที่ 10)

**Client**

บริษัท กรีน เทคโนโลยี เอเซีย จำกัด

A3



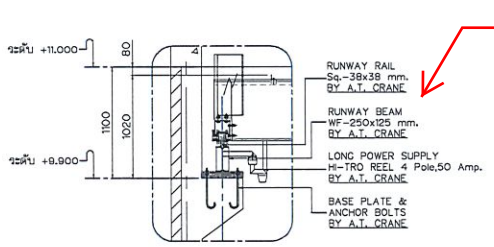

CRANE Cap. 5 Tons.
รูปตัด ก-ก

CRANE TOP VIEW Cap. 5 Tons.

ข้อ7.3.2

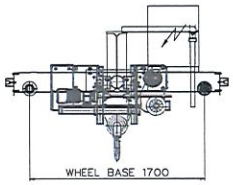
ข้อ12.7.1

ข้อ12.7.3




DETAIL "A"
Scale 1:50

ข้อ7.5




CRANE SIDE VIEW Cap. 5 Tons.
Scale 1:50

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สามัญวิศวกรเครื่องกล
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บริษัท เอ.ที. เครน จำกัด

Single Girder Crane Cap. 5 T.
Span 5 m., L/H 9 m., Runway 7 m.

กรมชลประทาน

โครงการส่งน้ำและบำรุงรักษาบางบาล
ปรับปรุงสถานีสูบน้ำที่ 10
ต.บ้านรุน อ.พระนครศรีอยุธยา จ.พระนครศรีอยุธยา

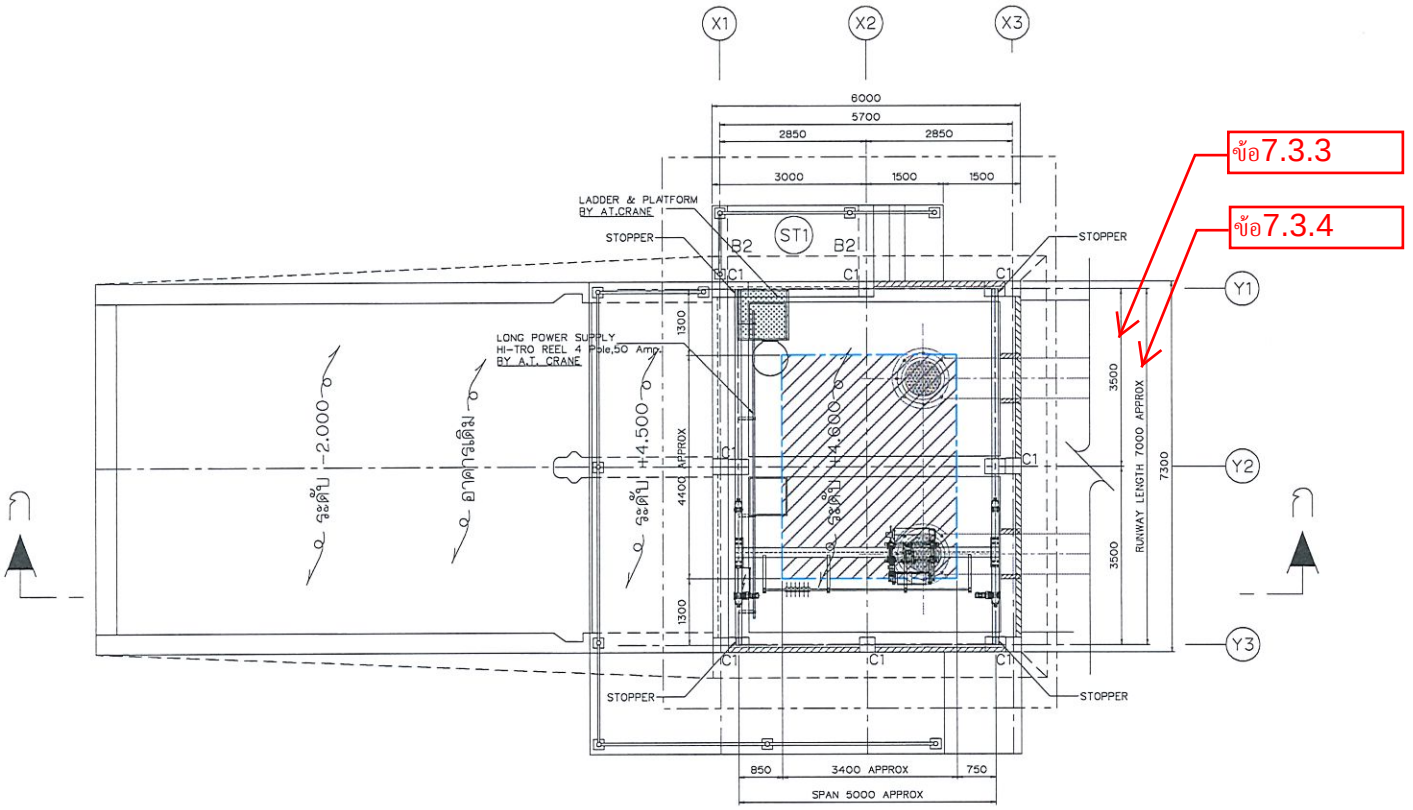
สถานีสูบน้ำ
แบบแสดงเครน

TECHNICAL DATA

| | | | |
|---|---|---|---|
| CAPACITY | : 5 Tons (LH/9m.) Max 9m. | END CARRIAGE MODEL | : ETN11-1750 |
| MODEL | : ATC-WS-5T-M5-9M | MOTER DRIVE | : 5-->20 m/min. 2x0.37 kW |
| LIFTING SPEED (2 SPEED) | : 5/0.8 m/min. 6.1/0.9 kW 40%ED | CRANE DRIVE GROUP | : (FEM GROUP 2m/M5) |
| CROSS TRAVEL (INVERTER) | : 5-->20 m/min. 0.37 kW 100%ED | PUSH BUTTONS STATION | : SUSPEND FROM HOIST (IP65,2 STEP-6BUTTONS+EMER) |
| HOIST GROUP | : (FEM GROUP 2m/M5) | OPERATION VOLTAGE | : 380 VOLTS 3 PHASE 50 Hz |
| | | CONTROL VOLTAGE | : 48 VOLTS |

ผู้รับจ้าง: A.T. CRANE CO.,LTD

| | | | |
|---|---|---|---|
| ออกแบบ | ASAMA | กรมชลประทาน | |
| เขียน | ASAMA | ตรวจ | |
| ตรวจ | ATHIT | ผ่าน | |
| อนุมัติ | ATHIT วันที่ 08-03-2024 | เห็นชอบ | |
| สำนักงานจำหน่ายงาน มีมูลนายที่ สว. | วันที่ | อนุมัติ | |




CRANE LAYOUT & WORKING AREA
CRANE Cap. 5 Tons.

ข้อ7.3.3

ข้อ7.3.4

นายศิลปชัย เพิ่มพูล
สามัญวิศวกรเครื่องกล
สก.3393

A.T. CRANE CO.,LTD.

Single Girder Crane Cap. 5 T.
Span 5 m., L/H 9 m., Runway 7 m.

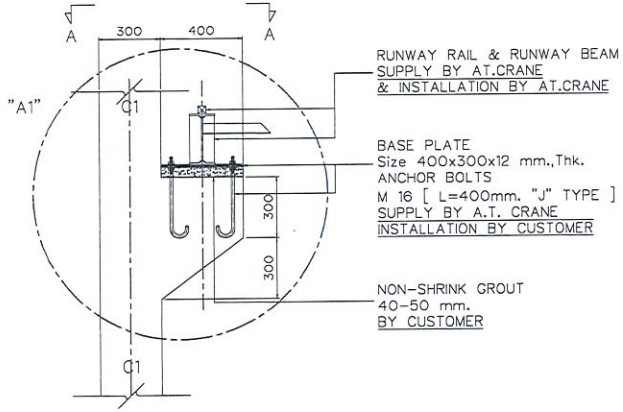
กรมชลประทาน

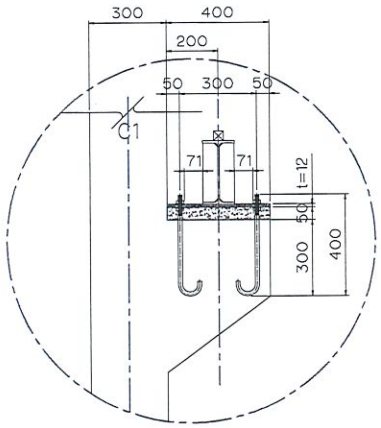
โครงการส่งน้ำและบำรุงรักษาบางบาล
ปรับปรุงสถานีสูบน้ำที่ 10
ต.บ้านจุ้น อ.พระนครศรีอยุธยา จ.พระนครศรีอยุธยา

สถานีสูบน้ำ

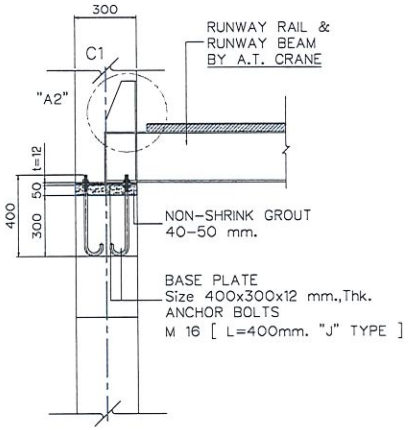
แบบแสดงเครน

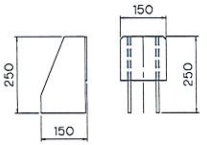
| | | | |
|---|---|---|---|
| ผู้รับจ้าง: | A.T. CRANE CO.,LTD | | |
| ออกแบบ | ASAMA | กรมชลประทาน | |
| เขียน | ASAMA | ตรวจ | |
| ตรวจ | ATHIT | ผ่าน | |
| อนุมัติ | ATHIT วันที่ 08-03-2024 | เห็นชอบ | |
| ตำแหน่งเจ้าหน้าที่ผู้อนุมัติ | วันที่ | อนุมัติ | |



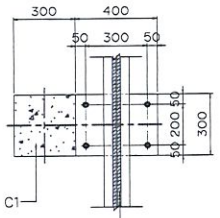




"DETAIL : A 1"
Scale 1:20



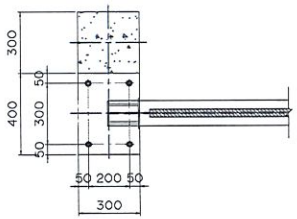




DETAIL "A2"
STOPPER




RUNWAY RAIL &
RUNWAY BEAM
BY A.T. CRANE

SECTION A-A




ข้อ14.2

Detail Installation Base plate & Anchor Bolts.
Runway beam WF-250x125 mm.

Single Girder Crane Cap. 5 T.
Span 5 m., L/H 9 m., Runway 7 m.

กรมชลประทาน

โครงการส่งน้ำและบำรุงรักษาบางบาล
ปรับปรุงสถานีสูบน้ำที่ 10
ต.บ้านรุน อ.พระนครศรีอยุธยา จ.พระนครศรีอยุธยา

สถานีสูบน้ำ
แบบแสดงเครน

ผู้รับจ้าง: A.T. CRANE CO.,LTD

| | | | |
|---|---|---|---|
| ออกแบบ | ASAMA | | กรมชลประทาน |
| เขียน | ASAMA | ตรวจ | |
| ตรวจ | ATHT | แบบ | |
| อนุมัติ | ATHT วันที่ 08-03-2024 | เห็นชอบ | |
| สำนักกลจำหน่ายประทาน | | อนุมัติ | |
| มีบุญมหาศักดิ์ | วันที่ | | |
| ลว. | | | |

A.T. CRANE CO.,LTD
นายศิลปชัย เพิ่มพูล
สามัญวิศวกรเครื่องกล
สก.3393

**A.T.CRANE CO., LTD.**

**บริษัท เอ.ที.เครน จำกัด**

---

**Document Title**

# MANUAL

## Project

Electric Overhead Travelling Crane Single girder Cap. 5 Tons.

จัดหาและติดตั้งเครื่องสูบน้ำ ชนิดเพลาตั้ง และจัดหาและติดตั้งระบบผลิตไฟฟ้าพลังงานแสงอาทิตย์ สำหรับงานปรับปรุงสถานีสูบน้ำด้วยไฟฟ้า 5 สถานี โครงการส่งน้ำและบำรุงรักษาบางบาล ตำบลบ้านป้อม อำเภอพระนครศรีอยุธยา จังหวัดพระนครศรีอยุธยา

(สถานีสูบน้ำโรงสูบน้ำที่ 10)

**Client**

บริษัท กรีน เทคโนโลยี เอเซีย จำกัด

# ATC-WS Single Girder Electric Wire Rope Hoist Owner's Manual

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# 1 GENERAL INTRODUCTION

## 1.1 Foreword: About this Manual

This manual offers guidance to enable safe and efficient operation of the equipment.
Taking the time to read this manual will help you to prevent damage to the equipment, and, most importantly, personnel situated close to it. The equipment is designed to be safe when used correctly. However, there are many potential hazards associated with incorrect operation and these can be avoided when you know how to recognize and anticipate them.
This manual will also make you aware of your responsibilities with respect to the equipment and help you to ensure that it is kept in a safe operating condition throughout its lifetime.
This manual is not intended as a substitute for proper training but provides recommendations and methods for safe and efficient operation and maintenance. The equipment's owner must ensure that operators are properly trained prior to operation and, at all times, comply with all of the applicable and prevailing safety and other standards, rules and regulations.
Read also the safety instructions.

## 1.2 Symbols Used in this Manual

Readers should familiarize themselves with the following symbols which are used in this manual.

| | |
|---|---|
|  | Indicates that the product is slowing down or is moving at its slowest speed. |
|  | Indicates that the product is accelerating or moving at its highest speed. |
|  | **NOTE:** Indicates items which require special attention by the reader. There is no obvious risk of injury associated with notes. |

## 1.3 Safety Alert Symbols and Signal Words

The following symbols are used in this manual to indicate potential safety hazards.

| | |
|---|---|
|  | **Obey all safety messages that follow this symbol to avoid possible injury or death.** |
|  **CAUTION** | **Indicates a potentially hazardous situation, which if not avoided, MAY result in minor or moderate injury. It may also be used to alert against unsafe practices.** |
|  **WARNING** | **Indicates a potentially hazardous situation, which if not avoided, COULD result in death or serious injury.** |
|  **DANGER** | **INDICATES AN IMMINENTLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.** |

| | |
|---|---|
| **NOTICE** | Addresses situations not related to personal injury, such as likely or possible damage to equipment. |

| | |
|---|---|
| **SHALL** | Indicates that a rule is mandatory and must be followed. |

| | |
|---|---|
| **SHOULD** | Indicates that a rule is a recommendation, the advisability of which depends on the facts in each situation. |

## 1.4 Questions and Comments

Any questions or comments relating to the content of this manual and/or the operation, maintenance and/or service of manufacturer products should be directed to: info@atcrane.co.th

## 1.5 Exclusion of Warranty

The manufacturer makes absolutely no warranty whatsoever with regard to the contents of this manual, express or implied, whether arising by operation of law or otherwise, Including, but not limited to, any implied warranties of merchantability Or fitness for a particular purpose.

## 1.6 Manual Use

Every person exposed to the manufacturer's equipment must, prior to Operating, serving and/or maintaining such products, read and understand the contents of this manual and strictly adhere and conform their conduct with and or the information, redommendations and warnings provided herein.



**Note:** Keep these instructions in a safe, accessible location for future reference by personnel operating the equipment or exposed to the equipment's operation.

| | |
|---|---|
|  | **Read and understand the contents of this manual prior to operating, servicing, and or/maintaining the equipment. Failure to do so can result in serious injury or death.** |

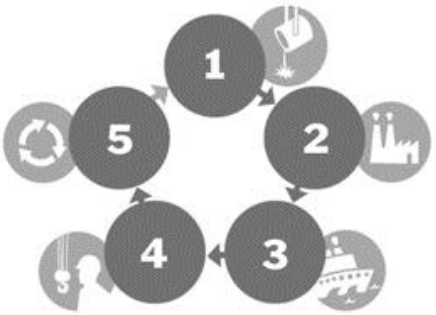
Manufacturer shall not be liable for and owner and reader shall release, and hold manufacturer, harmless from any and all claims, demands, and damages, regardless of their nature or type losses and expenses, whether known or unknown, present or future, any and all liability, of and from any and all manner of actions, cause[s] of actions, all suits in law, in equity, or under statute, State or Federal, of whatever kind or nature, third party actions, including suits for contribution and/or indemnity on account of or in any way arising out of acts or omissions of the Owner or reader and relating in any way to this manual or the products referenced herein, including, but not limited to the owner's or reader's use thereof or any other cause identified herein or that may be reasonably inferred HEREFROM.

## 1.7 Environmental product declaration

Product lifecycle
The environmental impacts of the hoist product family are taken into account for the whole life cycle of the product. The lifecycle of the product consist of acquisition of raw materials and energy, component production, assembly, packaging and transports, use, maintenance and disposal of the product. The

lifecycle stages are described in the picture below. Each lifecycle stage has an impact on the environment.

**Hoist and crane life-cycle stages:**

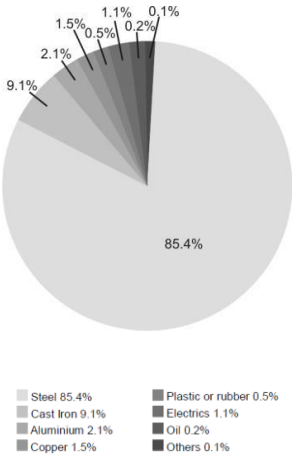



1. Raw materials, energy and component production
2. Hoist and crane manufacturing
3. Delivery to the customer
4. Use and maintenance
5. Dismantling and handling of waste materials

Based on our knowledge, the most significant environmental impact of hoists is the energy consumption during the use phase, and in particular the environmental impacts of the electricity production. In the case of cranes, the most significant environmental impact is the raw material acquisition, in particular the production of steel.

Environmental impacts of the other lifecycle stages are the following: VOC-emissions and waste generated during assembly in manufacturing phase; energy consumed during transportation and production of packaging material in delivery phase; energy consumed of service vehicles and production of spare parts and lubricants during maintenance phase, and material recycling in disposal phase.

Below the most significant lifecycle stages are described more in detail.




**Raw-material acquisition and component production**

- The product is composed mainly of steel and cast iron. The chart indicates the approximate
  - composition of a hoist with trolley. Proportions may vary slightly, depending on the size and
  - features of the hoist and trolley.
- This product does not contain asbestos, ozone depleting substances, PCB or any other legally
  - banned hazardous materials.
- Factory-installed lubricants in the product are industrial hydrocarbons.

**Manufacturer**

Materials and components are supplied by various suppliers worldwide.

**Delivery**

Product packaging is recyclable and consists of 95 – 96% plywood, 3 – 4% plastics and 1% metals (standard packaging).

- Attention has been paid to optimizing packaging sizes to enable efficient shipments and to reusing packaging internally. Products are transported mainly by trucks or ships. Transport distances are minimized by supplying orders from the factory closest to the customer.

**Electricity consumption**

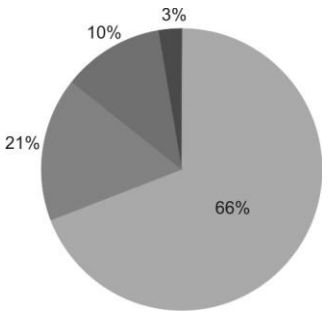
- Electricity is needed for hoisting and traveling motions, as well as for motor stand-by heating, cubicle heating and cooling, and other electrical appliances which are part of the hoist or crane.
- Floodlights may in some cases contribute to a substantial part of the energy consumption.
- The stand-by mode of certain appliances also contributes to the energy consumption.
- The use of variable-speed electric drives act as the main tool for reducing energy consumption associated with hoisting and traveling motions.
- International standards are not available for the assessment of the energy consumption of hoists and

cranes; hence the given examples are based on a calculation tool developed by the manufacturer. As a hoist is most typically a part of a crane, the results are presented for the whole crane

**Example 1. ATC-WS (10t) Indoor use**

ISO Class M4. 6000 cycles /year. One operating cycle includes 2m hoisting, 5m trolley and 8m bridge movement and 2 m lowering. 60% of operating cycles are performed at 10t load and 40% at 8t load. Return cycles with an empty hook are included.

Total energy consumption: **310 kWh/ vear**

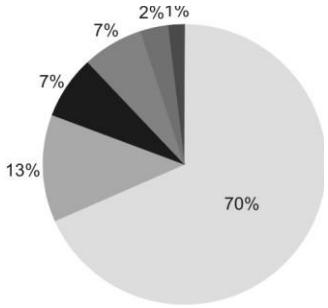



Hoisting 66% Bridge movement 10%
Transformer 21% Trolley movement 3%

**Example 2. ATC-WS (10t) Outdoor use**

ISO Class M6. 23600 cycles /year. The operating cycle is similar to Example 1. With floodlights 4 x 400W and standby heating for motors and panels

Total energy consumption: **6000 kWh/year**




Floodlights 70% Transformers 7%
Hoisting 13% Bridge movement 2%
Heating 7% Trolley movement 1%

**Sound pressure levels**

- Hoists generate some audible sound during operation. The total sound level experienced in the operating area is a combination of the individual sound sources around the operator. The main sources of sound from the hoist arise from its components, vibrating structures and reflective surfaces. Hoist components that generate noise include the hoisting machinery (motor, gears and brakes) and trolley, bridge and other moving structures associated with the hoist.
- Sound pressure levels of hoist are presented in the table. Depending on the working site, the sound pressure level the operator feels can be higher or lower. Experienced sound level can be higher if, for example, the building structure resonates heavily or the walls or other surfaces at the working site reflect sound toward the operator.

**Dismantling and handling of waste materials**

- Waste material from installation, maintenance or dismantling shall be handled and disposed of according to local regulations.
- Based on the EU's waste hierarchy, the preferred waste handling methods are, starting with the most preferable prevention, reuse, recycle, recovery, and as a final resort, safe disposal.
- As waste regulations and types of available recovery and disposal methods vary regionally, no general detailed guidance can be given. Always use licensed waste-handling companies. In many cases, multi-metal scrap is the available handling method. Before that, electric parts and lubricants must be removed and handled separately.
- This product is not within the scope of the EU directive 2002/96 (Waste Electrical and Electronic equipment).

| Proposed waste handling methods (example for EU states) | |
|---|---|
| **Material** | **Handling method** |
| Metal parts | Material recycling |
| Plastics | Material recycling or recovery to energy |
| Electrical and electromechanical parts | Recycling, hazardous waste management if needed |
| Accumulators | Recycling, hazardous waste management |
| Lubricants | Recycling, hazardous waste management |
| Packing material | Material recycling or recovery to energy |

This environmental product declaration contains self-declared environmental claims of the product in question according to ISO 14021.

## 1.8 Terminology

The following terms and definitions may have been used in this manual:

| | |
|---|---|
| **ANSI** | American National Standards Institute |
| **ISO** | International Organization for Standardization |
| **Authorized personnel** | Persons who are authorized by the owner and who have the necessary training to carry out operation or service actions. |
| **Experienced service person authorized by the manufacturer** | A person with service experience who is properly trained to perform service actions. |
| **CE marking** | The CE-marking indicates that the product complies with the appropriate CE regulations. |
| **Check** | A visual and functional assessment (not a test) of the product without dismantling. |
| **Emergency brake** | A brake that can be applied by the operator, or automatically upon loss of power. |
| **Electric panel** | Power is controlled to the motors and components through the electric panel. |
| **Parking brake (storm lock)** | A brake that can be applied either automatically or manually and prevents horizontal movement of the trolley or bridge. Used when movements need to be prevented in windy conditions. |
| **Main brake** | A brake that stops motion and prevents movements. |
| **Second brake (Holding brake)** | A brake that supports the load if the main brake fails. |
| **Operator** | Person operating the product for the purpose of handling or moving loads. |
| **Inching** | Making very small movements by repeatedly and momentarily pressing the direction control. |
| **Bridge** | The bridge (main girder) moves along the runway |
| **Main girder** | The main girder (bridge) is connected to the bridge end carriages. |
| **Main isolation switch** | The main isolation switch is the power switch which the operator should normally use to turn off the power. |
| **Hoist** | Drive mechanism for lifting and lowering the load. |
| **Inspection (Visual)** | Looking for defects and checking the operation of the controls, limiting and indicating devices without loading the product. This is much more than a check but does not normally require any part of the product to be dismantled other than for removal or opening of covers or housings. |
| **Power supply** | Power is supplied to the components via the power supply. |
| **Controller** | The pendant or other type of controller is used by the operator to give commands to the product. |

| | |
|---|---|
| **Qualified personnel** | One with necessary qualification based on theoretical and practical knowledge of hoists or/and cranes. The person must be in a position to assess the safety of the installation in conjunction with the application. Persons with the authority to undertake certain maintenance work on products of manufacturers include manufacturers' service engineers and trained fitters with corresponding certification. |
| **Maximum capacity** | Load that the product is designed to lift for a given operating condition (e.g. configuration, position of the load). |
| **Runway** | The product rides on or under the runway. |
| **Trolley (hoisting unit)** | The trolley (hoisting unit) moves along the main girder. |
| **Sling** | A sling is used to attach the hook to the load when the load cannot be lifted directly by the hook. |

# 2 SAFETY FIRST!

Safety requirements must be understood and followed.

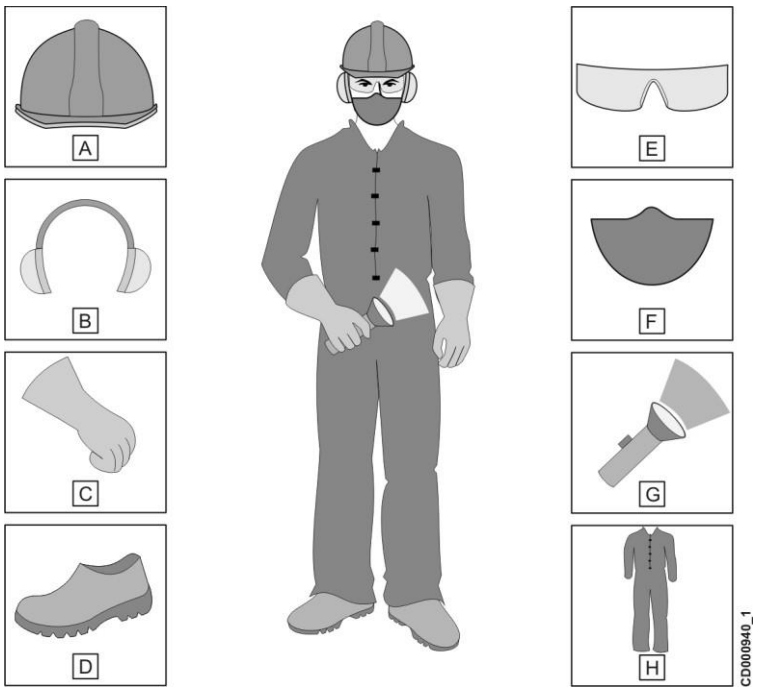
## 2.1 Personal Protective Equipment (PPE)

**Note:** This chapter proposes personal protective equipment to ensure operator's full safety. Local regulations and requirements of the working environment shall be followed.

For safety, the operator or others in close proximity to the product may be required to wear Personal Protective Equipment (PPE). Various types of PPE are available and must be selected according to the requirements of the working environment. Some examples of different types of PPE are:

**Typical PPE**

A. Hard hat
B. Hearing protection
C. Gloves
D. Safety shoes
E. Safety goggles
F. Face mask
G. Flashlight for use in case of power failure
H. Overalls




Appropriate clothing must be selected for each task. For example:
Fire-resistant clothing must be worn when welding, flame cutting or using an angle grinder.
Tear-resistant clothing must resist damage from sharp edges in the steel structure.
Anti-static clothing must be worn when working on electrical circuits so that components do not get damaged by a discharge of static electricity.
When working with lubricants, clothing must prevent direct skin contact with the lubricant.
Clothing should be chosen with consideration to the temperature at the working site.

### 2.1.1 Fall protection



While personnel are performing inspection or maintenance work at heights, they must follow fall protection procedures as required by local regulations. Fall prevention practices and fall protection equipment aim to protect personnel working on or around the equipment from exposure to falls.
If the equipment does not have a service platform or handrail, personnel must use a properly fitted safety harness that is attached to the dedicated fixing points on the building or equipment in order to prevent falls.
If the product does not have dedicated fixing points for fall protection, it is the owner's responsibility to make sure that there are suitable fixing points in the building structure.
If ladders must be used, personnel must practice setting and securing the ladders before using them for actual work.
A typical fall protection program may include:

- Documented and established site policies and procedures.
- Conducting site assessments for fall hazards.
- Selection of the proper fall protection system and equipment.
- Training on fall protection procedures and the proper use of fall protection systems.
- Inspection and proper maintenance of fall protection equipment.
- Measures to prevent falling objects.
- Rescue Plans.

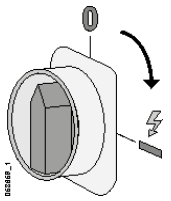
If necessary, contact your supplier or service organization for assistance with designing your fall protection program.

## 2.2 Fire Safety

In the event of a fire, only attempt to fight it if you can do so without putting yourself in danger. Turn the power off if it is possible to do so. Evacuate the area. Notify other people about the potential danger, and call for help.

| | |
|---|---|
| **WARNING** | **Never use a powder type fire extinguisher on high voltage.** |

## 2.3 Main Isolation Switch



The product can only be driven when power is turned on. The owner must identify and document the location and function of the **main isolation switch** and must communicate this information to all operators.

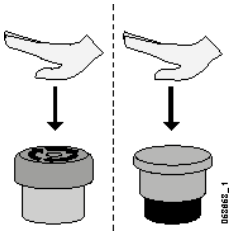
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| **CAUTION** | **Owner/Operator shall be aware of main isolation switch functionality. Even though one switch is turned off, there may still be voltage present in some parts of the product. This may result in exposure to electric shocks.** |

| | |
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| | **The operator shall not operate the product unless he or she knows the location of the main isolation switch.** |

| | |
|---|---|
| **CAUTION** | **Avoid turning off the main isolation switch during load movement. Sudden loss of power may cause the load to swing and cause serious damage to the product, personnel or load.** |

When the **main isolation switch** is turned on after being placed in the off position, the set-up procedure must be followed before the product can be used.

## 2.4 Emergency Stop



In the event of an equipment malfunction or other emergency situation, all motions can be stopped immediately by pressing the red emergency stop button located on the controller. In normal operation, the emergency stop button should not be used instead of making proper use of the direction controls. Routinely using the emergency stop button increases wear on the product and can cause the load to swing.

| | |
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| **NOTICE** | Only use the emergency stop button to stop movement in the event of a product malfunction or other emergency situation. Using the emergency stop button can cause the load to swing unexpectedly. |

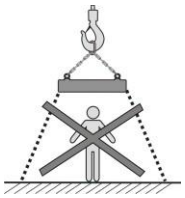
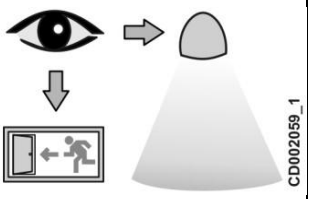
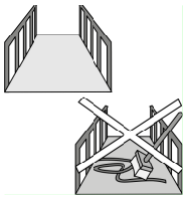
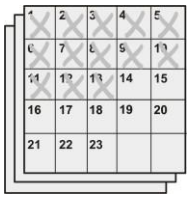
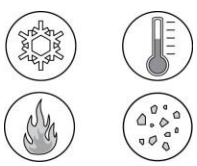
| | |
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| | **The operator shall not operate the equipment unless he or she knows the location of the emergency stop button.** |

## 2.5 Owner's Responsibilities

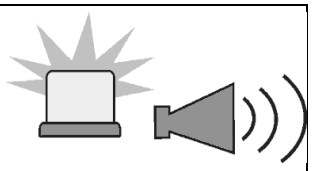
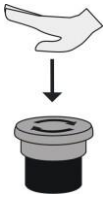
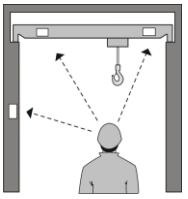
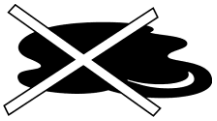
### 2.5.1 General Safety Issues

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| ⚠ **CAUTION** | **No modifications or additions to the equipment structures or performance values are permitted unless they are first discussed with and approved by the manufacturer or manufacturer's representative of the equipment.** |

| | |
|---|---|
| **NOTICE** | Modifying the equipment without the manufacturer or manufacturer's representative approval can invalidate the guarantee. Furthermore, the manufacturer does not accept responsibility for accidents which happen as a consequence of unauthorized modifications. |

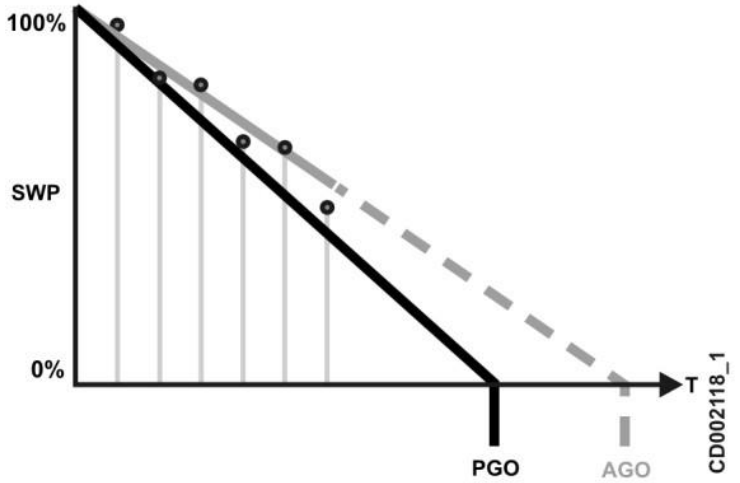
| | | |
|---|---|---|
| **1** | **Maintain safe conditions under the load**<br><br>Owners SHALL make it clear to all parties (including operator, service personnel and visitors), that no-one must ever venture underneath the load for any reason. This rule must be respected at all times. |  |
| **2** | **Maintain the lighting**<br><br>Owners SHALL ensure that there is adequate lighting, in good working order, at the operating site so that the equipment can be operated safely and efficiently at all times. |  |
| **3** | **Maintain walkways and service platforms**<br><br>Owners SHALL ensure that there are adequate walkways and service platforms on the equipment and/or adequate equipment at the operating site for servicing and inspecting the equipment. |  |
| **4** | **Maintain operating and safety requirements**<br><br>Owners SHALL ensure that the equipment meets the applicable (local and global) safety and operating requirements. |  |
| **5** | **Maintenance**<br><br>Owners SHALL ensure that maintenance is carried out at the recommended intervals as determined by the manufacturer. |  |
| **6** | **Maintain the operating conditions**<br><br>Owners SHALL ensure that conditions at the equipment operating site correspond to the operating conditions for which the equipment is designed.<br><br>For example, factors which affect the operating conditions include indoor/outdoor use, temperature, weather, dust, humidity, hazardous materials and fire risks. |  |

| | |
|---|---|
| **WARNING** | **Do not allow the equipment to be used unless it is in proper condition. In case of doubt, contact a service agent authorized by the manufacturer or manufacturer's representative! The use of defective equipment can result in serious damage, injury or death.** |

| | | |
|---|---|---|
| **7** | **Keep the product in a safe condition**<br><br>Owners SHALL ensure that the equipment is kept in a safe condition. For example, all warning devices must be kept in good working order. |  |
| **8** | **Fire safety**<br><br>Owners SHALL ensure that personnel are prepared in case of fire and that the correct fire-fighting equipment is available and maintained. |  |
| **9** | **First Aid**<br><br>Owners SHALL ensure that, in accordance with local regulations, personnel are prepared in case of accidents and that a suitable first-aid kit is available and maintained. |  |
| **10** | **Emergency Stop devices**<br><br>Owners SHALL ensure that they, and the operators, know the locations of emergency stop devices so that they can be activated in emergency situations.<br><br>Emergency stop devices should never be used as a substitute for making proper use of the direction controls. Routinely using the emergency stop button increases wear on the product components and can cause the load to swing. |  |
| **11** | **Ensure that signs are maintained in good condition**<br><br>Owners SHALL ensure that signs and warnings are present on the equipment and are in good condition. |  |
| **12** | **Keep the working site clean**<br><br>The working site should be kept free of clutter and dirt. Oil spills must be cleaned up immediately to reduce the risk of slipping. |  |

## 2.5.2 Hoisting Machinery Safe Working Period (SWP)

Based on how the hoisting machinery will be used and on the actual hoisting machinery hardware supplied, the manufacturer will agree the anticipated hoisting machinery lifetime or safe working period (SWP) with the customer at the time of purchase.
The total lifetime of hoisting machinery consists of one or more Safe Working Period (SWP) where each SWP typically lasts around ten years when the equipment is used in accordance with the designed usage. It is possible for different hoisting machineries on the same crane, for example main and auxiliary, to have a different SWP. The SWP is the period in which, provided the equipment has been used and maintained in line with the original expectations, the equipment can be safely operated.




*SWP = Safe Working Period*
*PGO = Predicted General Overhaul*
*AGO = Actual General Overhaul T = Time*

In practice the lifetime of the equipment can vary due to changes in the environment and usage of the equipment. For safety, in accordance with the ISO 12482-1 standard, it is important for authorized service personnel to periodically check the equipment duty group and operating conditions regularly for any changes, then to revise the remaining SWP% upwards or downwards accordingly. This action ensures that the equipment is kept operating for as long as it is safely possible before a General Overhaul must be conducted.

## 2.6 Intended Usage of the Product

The equipment for general use is an entity which has been designed to perform common lifting, travelling and lowering operations, within the limits specified by the equipment's duty group (see chapter "Duty group"). The hoisting machinery for general use must not be modified or used for any other purpose without the written approval of the manufacturer.
The hoisting machinery for general use is suitable for use in general manufacturing only; it is not suitable for use in harsh environments. Refer to "Operating environment". Please contact the manufacturer or manufacturer's representative in case of doubt.
The equipment must be positioned directly above (perpendicular to) the load so that there are no side-pulling forces.

| | |
|---|---|
| **CAUTION** | **Never allow the equipment to be used to pull or drag a load sideways. Side pulling accelerates hoisting machinery wear and can damage the rope reeving system. The load must always be lifted clear of the ground before performing travelling movements.** |

| | |
|---|---|
| **CAUTION** | **Side pulling may cause wire rope to break and the load to drop causing serious damage, injury or death** |

| | |
|---|---|
| **DANGER** | **DO NOT ALLOW THE EQUIPMENT TO BE USED FOR LIFTING PERSONNEL UNLESS THE MANUFACTURER OR MANUFACTURER'S REPRESENTATIVE HAS DECLARED IN WRITING THAT IT MAY BE USED FOR THIS PURPOSE.** |

Modifying the equipment without the permission of the manufacturer or manufacturer's representative can be dangerous and can invalidate the equipment guarantee. Any fundamental modifications to the equipment must be authorized in writing by the manufacturer. Examples of such modifications include:

- Welding or otherwise attaching new items to the equipment.
- Attaching devices for special material handling such as turning the load.
- Alterations to load-bearing components.
- Alterations to drives and speeds.
- Replacement of major items such as trolleys.

| | |
|---|---|
| **CAUTION** | **No modifications or additions to the equipment structures or performance values are permitted unless they are first discussed with, and approved by, the supplier of the equipment.** |

| | |
|---|---|
| **NOTICE** | Modifying the equipment without the manufacturer or manufacturer's representative approval can invalidate the guarantee. Furthermore, the manufacturer does not accept responsibility for accidents which happen as a consequence of unauthorized modifications. |

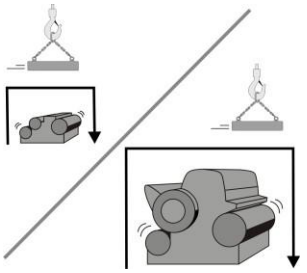
## 2.6.1 Duty Group

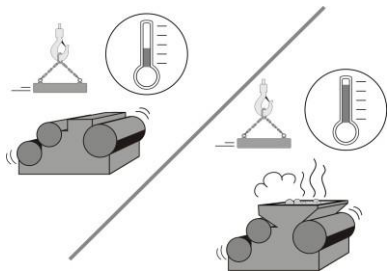
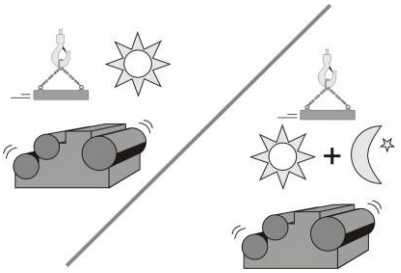
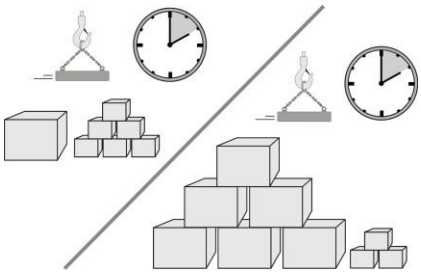
When the product is designed and purchased, the predicted lifetime of the product is agreed, based on the expected use of the product. This expected use is known as the duty group. Hoisting machinery which is used continuously to lift heavy loads is clearly in a very different duty group to a product of the same size which is used occasionally just to lift light loads. While the product is used in accordance with the designed duty group, the expected lifetime should be reached.

It is the owner's responsibility to ensure that the product is used according to the duty group that it has been designed for. By doing so, the product should reach the original predicted lifetime.

| | |
|---|---|
| **DANGER** | **DO NOT ALLOW THE PRODUCT TO BE USED OUTSIDE THE LIMITS OF THE SPECIFIED DUTY GROUP. DOING SO RAISES THE RISK OF MECHANICAL FAILURE AND CAN SHORTEN THE PRODUCT'S LIFETIME.** |

The duty group is based on many factors including the hardware, the predicted lifetime, the number of shifts and lifts, the distances traveled, the ratio of heavy to light items lifted and the environmental conditions the product is used in. Notice that, if you moved from single-shift working to three-shift working, you would need to reduce the loads or distances lifted and/or traveled in order to remain within the requirements of the duty group.

| Parameter | Variables | Light use and heavy use |
|---|---|---|
| Lifting height and working distances | Actual hoisting time and the average distances being traveled by the trolley and lifting devices. |  |

| | | |
|---|---|---|
| Operating environment | The product is designed to work within specific parameters of temperature, humidity and cleanliness. |  |
| Product process | The number of shifts. |  |
| | The number of work cycles per hour and the average lifted loads. |  |

Authorized service personnel must periodically check whether the product is being used according to the duty group. Owners and operators should recognize that any changes to product usage could, if left unchecked, raise overall maintenance costs and considerably reduce the safe operating lifetime of the product. Changes to any of the parameters and variables can require the duty group to be revised.
If there will be significant permanent changes in the product usage, authorized service personnel must revise the duty group and SWP as necessary. Changes to hardware or servicing frequency may be required.

## 2.7 Operating Environment

| | |
|---|---|
| **DANGER** | **USING THE EQUIPMENT IN AN ENVIRONMENT FOR WHICH IT IS NOT DESIGNED CAN BE DANGEROUS. IT WILL ALSO REDUCE THE EQUIPMENT'S LIFETIME AND INCREASE THE MAINTENANCE REQUIREMENTS.** |

If the operating environment deviates from the environment specified when the equipment was ordered, contact the manufacturer or manufacturer's representative. Solutions are available to enable the equipment to work in a wide range of operating environments. If the equipment for general use will be used in exceptional ambient conditions/temperatures or to handle dangerous materials, consult the manufacturer or manufacturer's representative. Examples of exceptional ambient conditions include windy areas, earthquake zones and corrosive atmospheres. Molten metal is considered to be a dangerous material.

The equipment for general use may be used in a normal default industrial environment only, with the following limitations:
Indoor products must be situated indoors, protected from outdoor weather conditions.

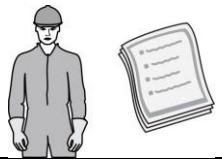
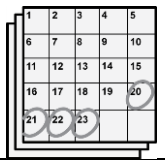
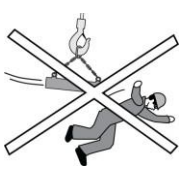
- The maximum ambient temperature must not exceed +40 ℃ (104 ℉).
- The minimum ambient temperature must not go below +5 ℃ (41 ℉).

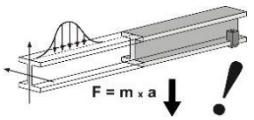
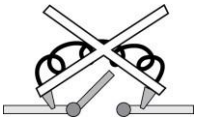
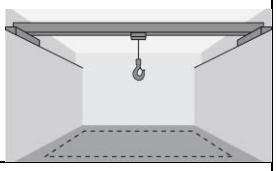
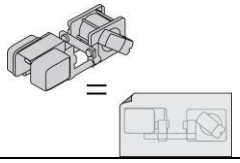
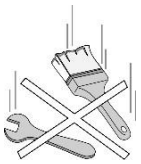
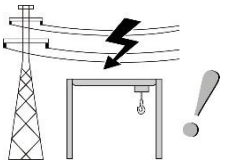
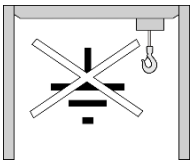
- The air must be clean in accordance with standard EN ISO 14644-1 (ISO Class 8).
- The equipment must not be exposed to any corrosive chemicals or an explosive atmosphere.
- The equipment must not be located in an area prone to earthquakes.
- The air relative humidity must not exceed 90%.



**Note:** There can be extra optional features in your equipment to allow operation in special environments such as outdoors. In case of doubt please contact your manufacturer or

## 2.8 Safety during Installation

| | | |
|---|---|---|
| **1** | **Ensure the competence of installation personnel**<br>Owners SHALL ensure that installation personnel are professionally competent, professionally qualified and are provided with adequate instructions for carrying out the work. |  |
| **2** | **Ensure proper commissioning and handover**<br>Owners SHALL ensure that the test loading, test drive and commissioning inspection have been properly executed and that the handover log has been properly completed. Owners SHALL ensure that components, electrical connections and steel structures of the product have been inspected and certified as defect-free. |  |
| **3** | **Documentation**<br>At handover, check with your supplier that you have received all of the documents that you are supposed to have and that they correspond to the equipment.<br>Owners SHALL ensure that all equipment documentation is available and is in the agreed language. |  |
| **4** | **Ensure availability of tools and equipment**<br>The owner must ensure that tools and equipment are available for installation, in accordance with the sales contract.<br>Lifting equipment, man lifters and test loads may be required.<br>Hand lines, securely attached to the building structure, should be used for lifting or lowering materials and tools. Use proper safety equipment to prevent objects from falling when working in high places. |  |
| **5** | **Allow sufficient time**<br>Owners must ensure that sufficient time has been reserved for installation and testing. |  |
| **6** | **Prevent unauthorized access to the site**<br>Owners must prevent unauthorized persons and bystanders from walking on or below the work site.<br>Ensure that the secured area is spacious enough to prevent injuries which could occur as a result of falling components or tools. |  |
| **7** | **Minimize the risks of moving machinery**<br>Make sure that there is no possibility for personnel or body parts to be struck, crushed or compressed by moving machinery.<br>Owners must secure the area so that installation personnel are not at risk from the movements of machines, automatic doors or adjacent cranes at the installation sit e. Ensure that machinery and equipment cannot start up accidentally and cannot move. |  |

| | | |
|---|---|---|
| | During installation and servicing. Maintain sufficient space in the working area to reduce the risks. Moving parts should be properly shielded with guards to prevent entrapment. Safety devices must never be overridden. Be prepared in case equipment moves in the wrong direction during testing. | |
| **8** | **Ensure that the runway is prepared for the product**<br>Owners must ensure that the runway is designed for the load of the equipment and that the runway rails meet the requirements and tolerances. The runway must be equipped with suitable buffer stops. |  |
| **9** | **Check the power supply is compatible**<br>Check that the supply voltage and frequency match the requirements of the equipment. Check that the installed bus bars are suitable for the equipment. |  |
| **10** | **Safety devices must be restored to operational status**<br>Ensure that any safety devices which have been bypassed for testing purposes have been restored to full operational status before allowing the equipment to be used for normal operation. Never bypass a safety device for normal operation. |  |
| **11** | **Check the environmental and space requirements**<br>Ensure that the operating environment and space reserved for the equipment in the operating location is suitable for all functions of the product. |  |
| **12** | **Check for dimensional conformance**<br>Immediately following installation and prior to commissioning, check that the supplied parts conform to the drawings, instructions, parts lists and structural measurements. Discuss any non-conformance with the supplier immediately. |  |
| **13** | **Ensure that there are no hazards from loose items**<br>Items which are not properly secured to the equipment, such as tools or detached components, could move or fall accidentally, with potentially serious consequences.<br>When dismantling the equipment, lower components to the ground at the earliest practical opportunity. |  |
| **14** | **Ensure that there are no electrical hazards**<br>Check for any electrical hazards in and around the working area and take appropriate steps to minimize them. Only properly trained personnel may perform electrical work on the product and they must use safe methods at all times. |  |
| **15** | **Take precautions if welding will be done at the site**<br>If there is a need for welding to be done at the site: Provide suitable fire extinguishers.<br>Do not allow any of the product structure or components to be used for grounding.<br>The hook must be isolated before any welding can be performed on it or equipment attached to it. |  |

## 2.9 Safety during Usage

This chapter only presents the owner's responsibilities towards the operator with regard to equipment usage. See instructions for the operator for detailed safety information concerning actual usage of the equipment.

| | | |
|---|---|---|
| 1 | **Operator training**<br>Owners SHALL ensure that operators are properly trained. Operators must know how to operate the equipment safely before starting to work with the equipment. |  |

## 2.10 Safety during Maintenance

Before and during equipment maintenance, the owner must take the following precautions:

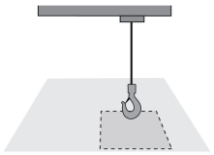
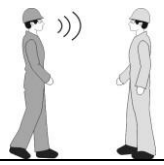
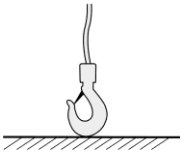
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|---|---|
| **NOTICE** | Safe access to the equipment is the owner's responsibility. |

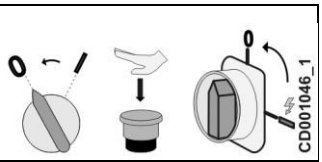
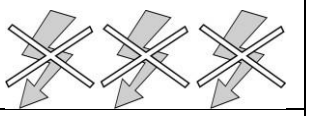
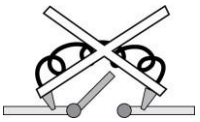
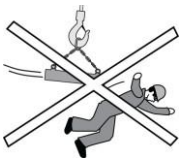
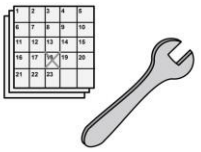
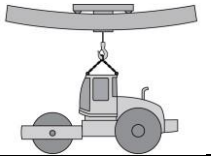
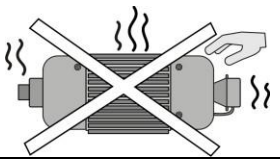
| | |
|---|---|
| **CAUTION** | **Use experienced service personnel, authorized by the manufacturer or manufacturer's representative, for servicing the equipment. The person servicing the equipment must be competent for the task and must be familiar with the servicing and inspection instructions.** |

| | |
|---|---|
| **CAUTION** | **After a collision or overload situation, inspection and repair operations to be carried out on the equipment must be discussed with the supplier.** |

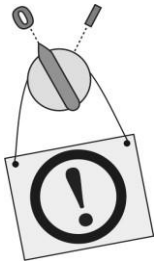
| | |
|---|---|
| **CAUTION** | **Only use genuine spare parts approved by the manufacturer.** |

Before and during equipment maintenance, the equipment's owner must be aware that the following precautions should be taken by maintenance personnel:

| | | |
|---|---|---|
| 1 | **Choose a safe working location**<br>The equipment should be moved to a location where it will cause the least disturbance and where it can be accessed easily. |  |
| 2 | **Prevent unauthorized access to the site**<br>Prevent unauthorized persons and bystanders from walking on or below the work site. For example, you can lock doors, install barriers and display notices.<br>Ensure that the secured area is spacious enough to prevent injuries which could occur as a result of falling components or tools. |  |
| 3 | **Inform that equipment will be undergoing maintenance**<br>Before starting maintenance, people must be properly informed that the equipment is being removed from operation. |  |
| 4 | **Ensure that there is no load on the lifting device**<br>Before starting maintenance there should be no load on the hook or lifting device.<br>Park the hook on the ground if there is any chance that the hoisting brake will be opened during maintenance. A raised empty hook will fall to the ground if the hoisting brake is opened. |  |

| | | |
|---|---|---|
| **5** | **Turn all controllers and main switches off**<br>All controllers and main isolation switches must be placed in the off position before starting maintenance. |  |
| **6** | **Lockout – Tagout**<br>The equipment power source must be locked out and tagged out when necessary, in accordance with local regulations. See chapter "Lockout - Tagout Procedure" |  |
| **7** | **Verify that power is completely disconnected**<br>Measure between the phases and between each phase to ground to ensure that power is completely disconnected from the equipment. |  |
| **8** | **Use hand lines for lifting and lowering tools**<br>Hand lines, securely attached to the building structure, should be used for lifting or lowering materials and tools. Use proper safety equipment to prevent objects from falling when working in high places. |  |
| **9** | **Safety devices must be restored to operational status**<br>Ensure that any safety devices which have been bypassed for testing purposes have been restored to full operational status before allowing the equipment to be used for normal operation. |  |
| **10** | **Minimize the risks of moving machinery**<br>Secure the area so that personnel are not at risk from the movements of machines, automatic doors or adjacent cranes at the installation site.<br>Ensure that machinery and equipment cannot start up accidentally and cannot move during installation and servicing.<br>Be prepared in case equipment moves in the wrong direction during testing. |  |
| **11** | **Perform regular inspections and preventive maintenance**<br>To ensure ongoing safe and efficient operation of the equipment, carry out regular inspections and preventive maintenance in compliance with the instructions. Keep a record of all inspections and servicing. If in doubt, contact the supplier of the equipment. |  |
| **12** | **Returning the equipment to operation after overload or collision**<br>After an overload or collision incident, the appropriate inspection and repair operations must be discussed with the supplier of the equipment. |  |
| **13** | **Pay special attention to all safety-critical components**<br>The brakes, limit switches, hook, rope and controller are all safety-critical items which must always be kept in good order.<br>Ensure that safety devices (overload protectors, limit switches, etc.) work properly so that they provide protection against human error. |  |
| **14** | **Beware of high temperature components**<br>Some components, such as the motors, can become very hot during use. Check that components are cool before working on them. |  |

## 2.10.1 Lockout - Tagout Procedure



During installation, inspection and maintenance, lockout-tagout procedures must be followed in accordance with local regulations and the documented site lockout-tagout policy. The owner must ensure that the operators are fully aware of the applicable lockout - tagout practices.
Lockout-tagout procedures are primarily intended to protect personnel by preventing accidental starting or exposure to electric shocks. Individual locks and tags are placed on controls to prevent their use until the person who installed the lock or tag removes it.

| | |
|---|---|
| **CAUTION** | **Never attempt to operate a control, switch, valve or other device when it is locked out or tagged out.** |

Items which are normally included in the documented lockout-tagout policy:
Communication requirements: who to inform before using lockout - tagout.

- When the use of lockout - tagout is permitted.
- Identification of each of the switches, controls, valves and other energy isolating devices present at the site. The role of each device should also be explained.
- The lockout - tagout sequences to be followed before, during and after maintenance.
- Safety and operational considerations regarding other products on the same runway or on adjacent runways.

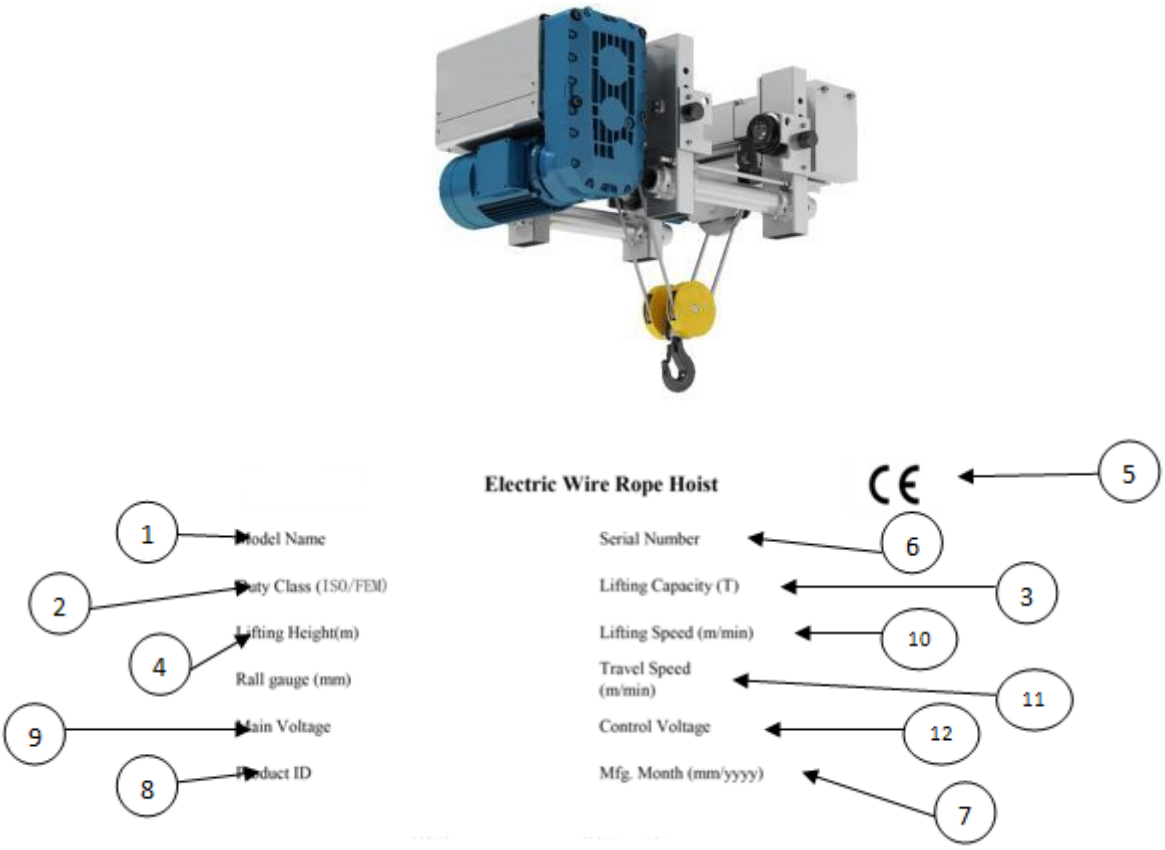
# 3 IDENTIFICATION

## 3.1 Manufacturer

Manufactured in Republic of China for A.T.CRANE CO., LTD.

**Note:** For further information about the product, operation, training or servicing, please contact the manufacturer or manufacturer's representative.

## 3.2 Hoist Identification Data

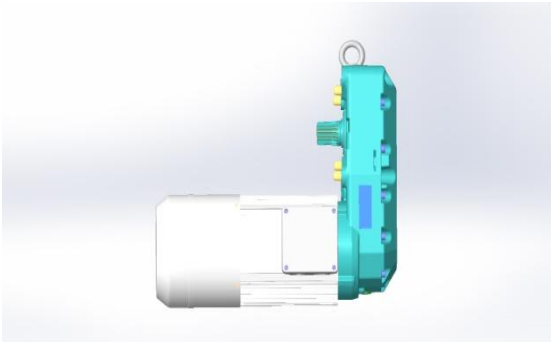


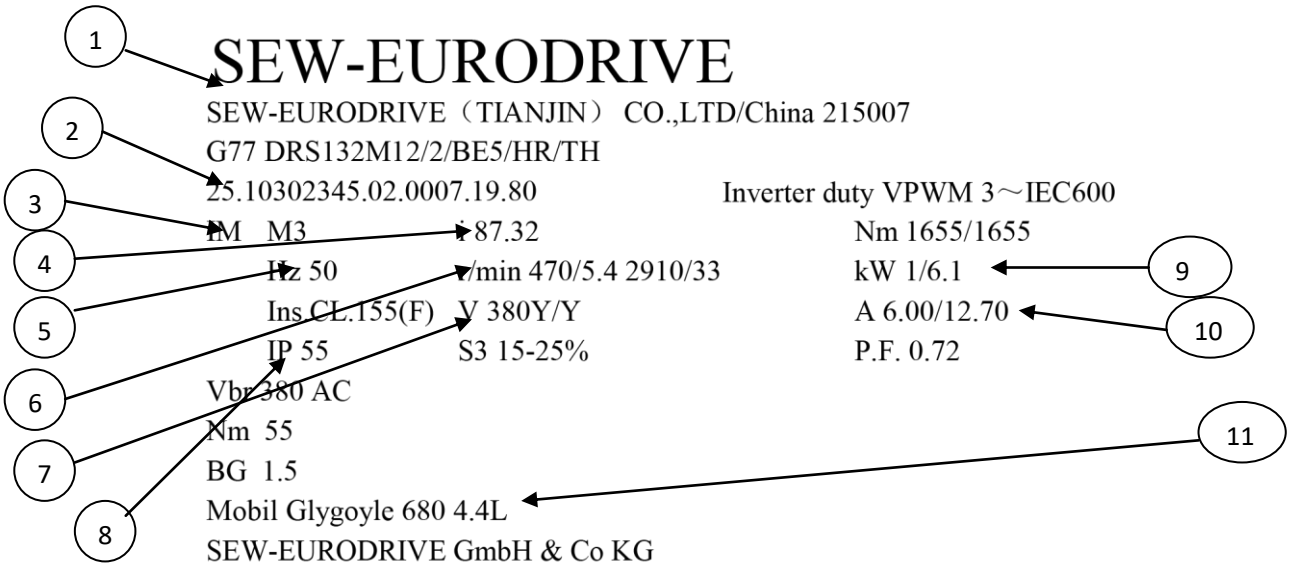

| | | |
|---|---|---|
| **1** | Product | Exact model of the product, product code. |
| **2** | Duty class | Duty group defined based on the expected use of the product |
| **3** | Load | Maximum load which can be lifted with the product |
| **4** | Height of lift | Maximum lifting height of the hook |
| **5** | Approvals and standards | Directives and approvals which the product complies to. Refer to the chapter "Standards and directives". |

| | | |
|---|---|---|
| **6** | Serial number | A unique number which identifies the product |
| **7** | Manufacturing month | Manufacturing month/year |
| **8** | Manufacturer's reference | Factory work number |
| **9** | Main voltage | Supply voltage which the product is designed for .Supply frequency which the product is designed for |
| **10** | Hoisting speed | High/low hoisting speed |
| **11** | Trolley speed | High/low trolley travelling speed |
| **12** | Control voltage | Control circuit voltage |

**Note:** The example data in the above figure is shown for illustration purposes only and does not match the data on your product.

## 3.3 Motor Identification Data



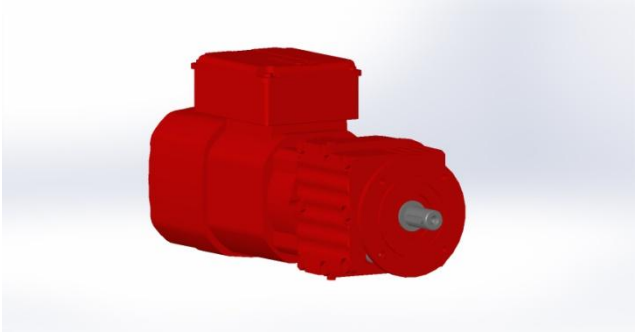


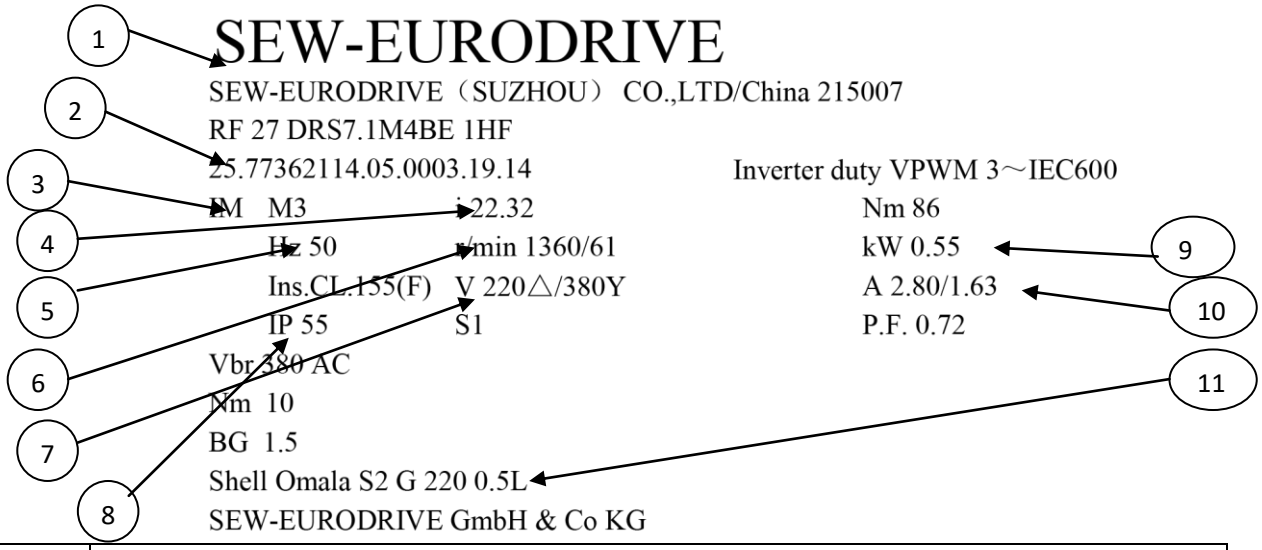

| | |
|---|---|
| **1** | **Manufacturer** |
| **2** | **Serial number** |
| **3** | **Configuration structural parameters** |
| **4** | **Reducer transmission ratio** |
| **5** | **Rated frequency** |
| **6** | **Rated speed** |
| **7** | **Acceptable main voltage range** |

| | |
|---|---|
| **8** | **Protection level** |
| **9** | **Rated power** |
| **10** | **Rated current** |
| **11** | **Lubrication Instructions** |

**Note:** The example data in the above figure is shown for illustration purposes only and does not match the data on your product.

## Traveling motor



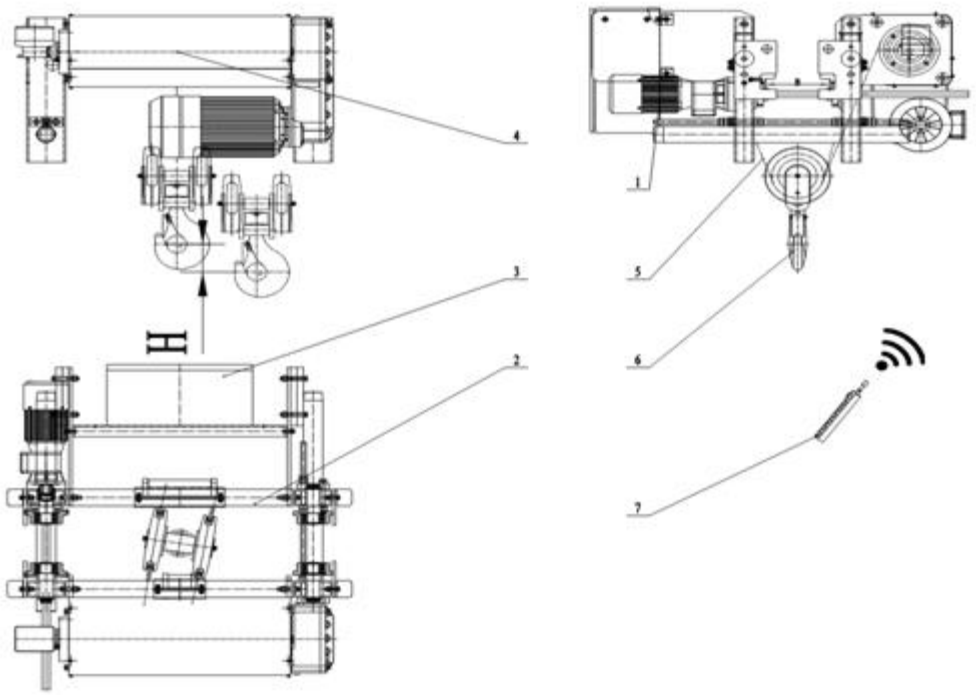



| | |
|---|---|
| **1** | **Manufacturer** |
| **2** | **Serial number** |
| **3** | **Configuration structural parameters** |
| **4** | **Reducer transmission ratio** |
| **5** | **Rated frequency** |
| **6** | **Rated speed** |
| **7** | **Acceptable main voltage range** |
| **8** | **Protection level** |
| **9** | **Rated power** |
| **10** | **Rated current** |
| **11** | **Lubrication Instructions** |

**Note:** The example data in the above figure is shown for illustration purposes only and does not match the data on your product.

# 4 CONSTRUCTION

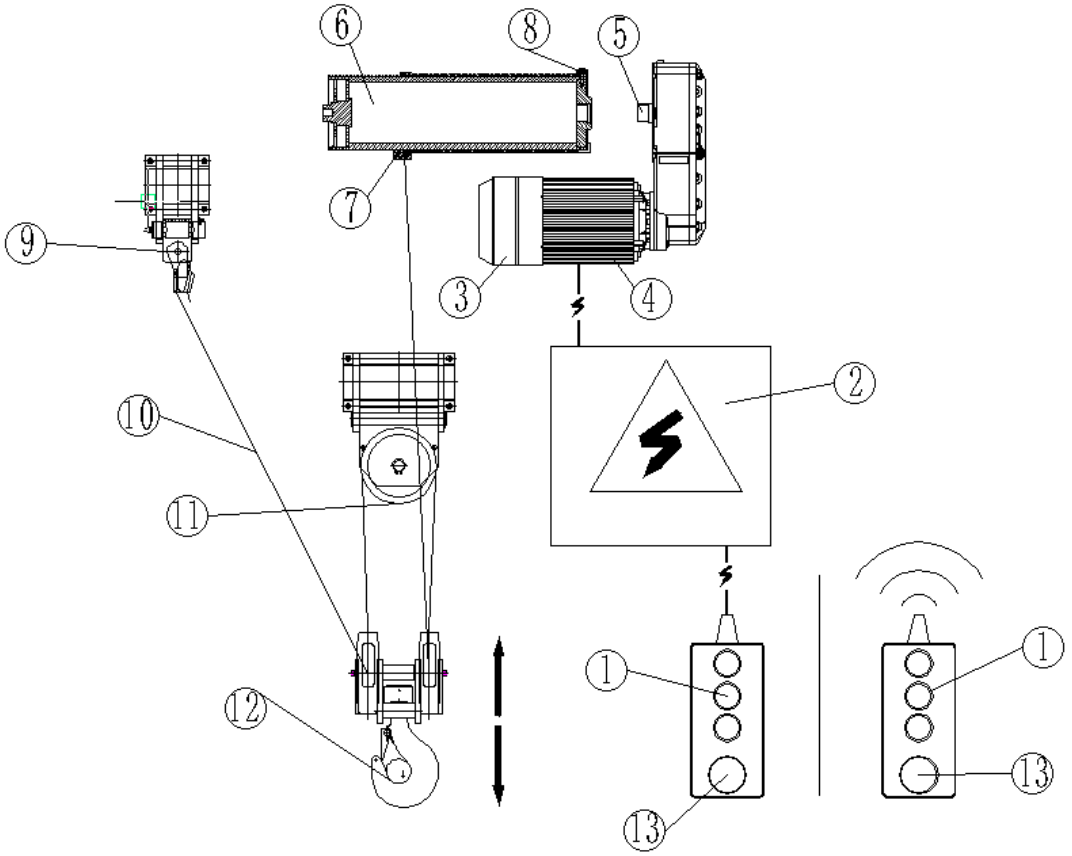
## 4.1 Identifying the Key Parts of the Hoist




| Pos. | Part | Description |
|---|---|---|
| **1** | Travelling machinery | Composed of travelling motor, gear and brake. |
| **2** | Rack | Composed of load beam. |
| **3** | Electrical cubicle | Electrical control system. |
| **4** | Hoisting machinery | Composed of hoist frame, hoisting motor, gear, brake and rope drum. |
| **5** | Rope | Composed of metal wires laid together like a helix. |
| **6** | Hook | Composed of hook forging and sheaves. |
| **7** | Controller | Pendant/Radio operates the control system. |

## 4.2 Main Functions

### 4.2.1 Hoisting Function




| Pos. | Part | Pos. | Part |
|---|---|---|---|
| **1** | Pendant or radio controller | **8** | Rope drum clamp |
| **2** | Electric panel | **9** | Rope anchorage |
| **3** | Brake | **10** | Wire rope |
| **4** | Motor | **11** | Sheaves |
| **5** | Hoisting gear | **12** | Hook |
| **6** | Drum | **13** | Emergency stop button |
| **7** | Rope guide | | |

**How the hoisting function works**

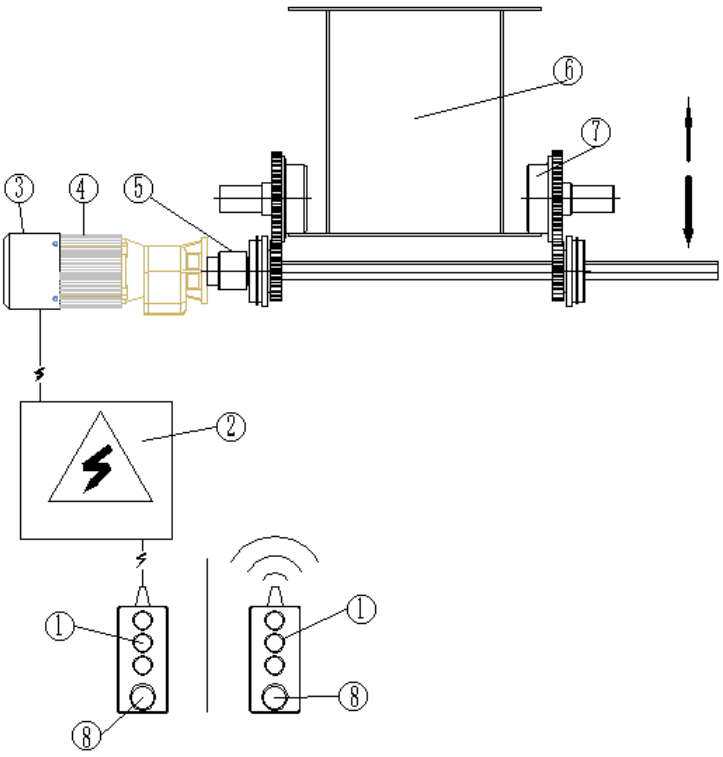
- When the relevant button or joystick is activated on the pendant or radio controller (1), the hook (12) moves vertically provided that certain conditions are met.
- The product has a variety of automatic built-in safety features which, for example, prevent lifting overload, limit travelling movements or prevent all the movements if the emergency stop button (13) is engaged. In addition, there can be operating limits (set by the owner/operator) which also limit movements under certain conditions.
- When a hoisting button or joystick is activated on the controller (1), a command is sent to the electric panel (2).
- The direction (up or down) of the hoist depends on which button or joystick is pressed. The speed of the hoist depends on which step is activated.
- The electric panel (2) controls the brake (3) and motor (4) in accordance with inputs from the

operator, together with signals from the sensors and safety devices.

- When the motor (4) is not being driven, the brake (3) holds the motor in place, preventing it from turning unintentionally and the load from sliding down.
- When a signal is transmitted from the controller (1), the electric panel (2) supplies power to the motor (4) and releases the brake (3).
- The motor (4) drives the hoisting gear (5) which drives the hoisting drum (6). The hoisting gear (5) reduces the rotation speed and increases the torque to lift the load.
- The wire rope (10) winds or unwinds when the hoist drum (6) rotates. The rope guide (7) guides the wire rope into the correct groove of the drum.
- One end of the rope is fixed to the hoisting drum (6) with a rope clamp (8). The other end of the rope is connected to the rope anchorage (9).
- The rope passes around the rope sheaves (11) into the rope anchorage (9). The hook block rises and falls when the rope winds onto or unwinds from the hoisting drum (6).
- In normal use, when the up or down control is released on the controller (1), the control closes the main brake and brings the hoist to a gradual, controlled stop.
- In emergency situations, the emergency stop button (13) on the controller (1) can be activated. This causes an instant stop of all movements by cutting power to the motors and applying the brakes.

| NOTICE | Only use the emergency stop button to stop movement in the event of malfunction or other emergency situation. Using the emergency stop button can cause the load to swing unexpectedly. |
|---|---|

## 4.2.2 Travelling Function




| Pos. | Part | Pos. | Part |
|---|---|---|---|
| 1 | Pendant or radio controller | 5 | Travelling gear |
| 2 | Electric panel | 6 | Rail |
| 3 | Brake | 7 | Wheel |
| 4 | Motor | 8 | Emergency stop button |

How the travelling function works

- When the relevant button or joystick is activated on the pendant or radio controller (1) the trolley travels horizontally along the track (6).
- The product has a variety of automatic built-in safety features which, for example, limit travelling movements or prevent all the movements if the emergency stop button (13) is engaged. In addition, there can be operating limits (set by the owner/operator) which also limit movements under certain conditions.
- When a travelling button or joystick is activated on the controller (1), a command is sent to the electric panel (2).
- The horizontal direction of the hoist depends on which button or joystick is pressed. The speed of the trolley depends on which step is activated.
- The electric panel (2) controls the brake (3) and motor (4) in accordance with inputs from the operator, together with signals from the sensors and safety devices.
- When the motor (4) is not being driven, the brake (3) holds the motor in place, preventing it from turning unintentionally.
- When a signal is transmitted from the controller (1), the electric panel (2) supplies power to the motor (4) and releases the brake (3).
- The motor (4) drives the travelling gear (5) which drives the wheel (7). The travelling gear (5) reduces the rotation speed and increases the torque to move the trolley.
- In normal use, when the travel direction control is released on the controller (1), the travel motion moves to a gradual, controlled stop and sets the parking brakes (inverter).
- In emergency situations, the emergency stop button (8) on the controller (1) can be activated. This causes an instant stop of all movements by cutting power to the motors and applying the brakes.

| | |
|---|---|
| **NOTICE** | Only use the emergency stop button to stop movement in the event of malfunction or other emergency situation. Using the emergency stop button can cause the load to swing unexpectedly. |

## 4.2.3 Safety Functions

**Hoisting unit**

| Device | Description |
|---|---|
| **Emergency stop switch** | The emergency stop switch is used to turn off power to the system in a dangerous situation. The emergency stop switch cuts the supply voltage to the system from the main contactor. Always eliminate the danger before releasing the emergency stop switch. There are several types of emergency stop switches but they are always red. |

| | |
|---|---|
| **Hoisting limit switch** | The hoisting limit switch is adjusted to prevent the hoist from traveling too high or low. The upper limit switch slows down and stops the movement so that only lowering is possible. The lower limit switch stops the downwards movement so that only lifting is possible. |

| | |
|---|---|
| ⚠ | **Hoisting limit switches shall always be adjusted by authorized service personnel. Verify that adjustment has been done before using the product.** |

| | |
|---|---|
| **Overload protection** | The overload device protects the machinery against overloading. Overload occurs at around 110% of the rated capacity of the crane or hoist. When the overload device activates, it prevents further lifting but you can still lower the load. Never use the overload device to assess the weight of the load. |

| | |
|---|---|
| **Fault supervision** | Fault supervision stops the motion of the product when one or more supervised safety features indicates a fault. Restarting is possible after the fault has been cleared. Note that some faults are direction dependent and running in the opposite direction is enough to terminate the fault. |

| | |
|---|---|
| **Phase supervision** | Phase supervision protects the machinery by detecting if a supply phase is missing or if the supply phase order is incorrect. When a fault is detected, no motions are possible until the power supply has been repaired. |

**Trolley**

| Device | Description |
|---|---|
| **Emergency stop switch** | The emergency stop switch is used to turn off power to the system in a dangerous situation. The emergency stop switch cuts the supply voltage to the system from the main contactor. Always eliminate the danger before releasing the emergency stop switch. |

| | |
|---|---|
| **Trolley anti-collision device(Optional)** | The trolley anti-collision device prevents hoists on the same bridge from colliding at high speed. The exact operation depends on the hoist. The device can slow down and/or stop the trolleys when they come close together, and it may still allow the trolleys to meet at slow speed. Driving the trolleys away from each other is possible. |

## 4.3 Signs

### 4.3.1 Safety Signs

Safety signs inform the operator about potential hazards and also about special features concerning the product's operation.

| | |
|---|---|
|  | **Failure to avoid dangers identified by these signs can result in death or serious injury.** |

| Sign | Description | Location on product |
|---|---|---|
|  | Danger of electric shock | On electric cubicle and other cubicles. |
|  | Danger of getting hurt | Places where serious injury may occur. |

## 4.3.2 Information Signs Used on the Hoist

Information signs present operational details which will help the operator to operate the hoist.

| Sign | Description | Location on product |
|---|---|---|
|  | **Lifting point** | On points which are intended for lifting |
|  | **Hoist numbering stickers** | Hoist and hook. |
|  | **Rope support installation instruction.** | Overload device<br><br>**Note!** Differences may occur. Check details for each hoist. |
|  | **Load stickers**<br>The hoist maximum rated capacity. | On hook block or lifting device |

# 5 INSTALLATION

Familiarize yourself with the installation instructions delivered with the hoist before commencing.

| | |
|---|---|
| ⚠ | **Before installation the instructions in chapter *"Safety first"* shall be read.** |

| | |
|---|---|
| ⚠ | **Installation procedure requires special skills and tools to ensure safe and reliable operation of the product. Installation work shall be carried out only by authorized service personnel or an experienced service technician authorized by the manufacturer or manufacturer's representative.** |

## 5.1 Installation preparations

The product is packed in a crate for transportation. To remove the hoist from the packaging, first remove the temporary transport supports.

| | |
|---|---|
| **NOTICE** | Make sure all components are delivered according to the order and undamaged. If delivery is damaged or incomplete, contact manufacturer or manufacturer's representative immediately for instructions. |



**Note:** If the hoist has been stored for a long time or has been transported by sea, check that the motors are dry , brake friction material is not bonded to friction surfaces, items are lubricated, electronic devices are recharged. Refer to chapter "Returning the product to use after a long period out of service".

Move the hoist to the installation location.

| | |
|---|---|
| ⚠ | **Before lifting the hoist the instructions in chapter "Lifting the oist"shall be read.** |

## 5.2 Lifting the hoist

### 5.2.1 Evaluating the weight of hoist

It is important that you know the weight of the hoist before commencing lifting so that you can select an appropriate lifting device and prevent overloading. The weight of the hoist can often be found from the packing list, the technical documents or the data plate.

| | |
|---|---|
| ⚠ **WARNING** | **Never lift a load that is heavier than the rated capacity of the lifting device. The load will fall if the lifting device fails.** |

| | |
|---|---|
| **WARNING** | **Never attempt to lift a load until you are satisfied that it weight is less than the maximum permitted load of the auxiliary lifting devices. Overloading can damage the auxiliary lifting devices.** |

| | |
|---|---|
| **WARNING** | **Do not use any overload device to determine whether the load can be lifted. Overload devices are not accurate enough and a load which does not trigger the overload device may still be heavier than the maximum permitted load. Overloading can damage the auxiliary lifting devices.** |

## 5.2.2 Auxiliary lifting device

The hoist is usually lifted by using auxiliary hoist and some kind of lifting device. The most common lifting devices are chains, wire rope slings and lifting belts. Every lifting device must be clearly marked with the maximum capacity and must be approved by authorities.

| | |
|---|---|
| | **Always follow instructions provided by the lifting device manufacturer and the local authorities! As the manufacturer of the hoist we are not responsible for lifting accessories provided by other manufacturers.** |

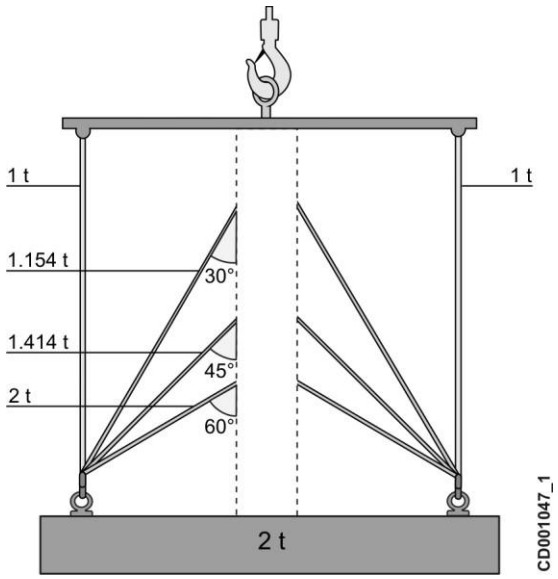
| | |
|---|---|
| **WARNING** | **Never use a lifting device which does not clearly display the maximum capacity or is not approved by authorities. The load will fall if the lifting device fails.** |

| | |
|---|---|
| **WARNING** | **Never use a lifting device which is unsuitable for the purpose. The load will fall if the lifting device fails.** |

| | |
|---|---|
| **WARNING** | **Never use a damaged lifting device. Carefully inspect lifting devices before using them. The load will fall if the lifting device fails.** |

## 5.2.3 Effect of the sling angle

The sling angle has a dramatic effect on the capacity of the sling. The maximum capacity of a sling depends on their angle, not just on their stated capacity. The stress on the slings increases as the angle between them increases. For example, to lift a 2 ton load with two slings angled at 80 degrees, each sling must be rated at 5.75 tons!




When the sling is at an angle, it exerts sideways strain which could bend or break lifting eyes. Check that the lifting eyes are designed to be used at the angle you plan to use.

| | |
|---|---|
| **WARNING** | **When slings are used at an angle, great strain is placed upon the slings and lifting eyes. This strain must always be considered. There is a danger that the slings or lifting eyes will break and that the load will fall.** |
| **WARNING** | **Use lifting eyes on hoist in accordance with the instructions so that they do not bend or break. The load may fall if lifting eyes are used incorrectly.** |
| | **Always follow instructions provided by the lifting device manufacturer and the local authorities! As the manufacturer of the hoist we are not responsible for lifting accessories provided by other manufacturers.** |

## 5.2.4 Before lifting

Check that the load is balanced and safely fastened at the lifting points. The load must not be able to slide, slip or detach itself when suspended.

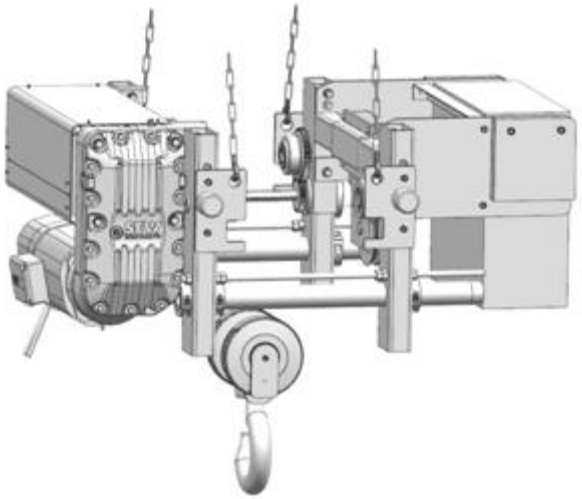
| | |
|---|---|
| **WARNING** | **Do not move the load until you have confirmation that it is properly attached to the lifting device. Moving the load prematurely can cause serious injury.** |
| **WARNING** | **Use lifting devices in accordance with the manufacturer's instructions.** |
| **WARNING** | **An unbalanced load is likely to drop and/or damage the product. Slings and harnesses must be positioned so that the pulling force of the auxiliary lifting devices lies on the hoist's centre of gravity.** |

**Note:** When you begin the lifting, check that it is properly balanced before lifting it high off the ground. If the load is not balanced, lower it down and adjust the lifting point.

| | |
|---|---|
| **WARNING** | **I If the load is not balanced, do not try to support it with your hands. Lower the load down and adjust the lifting point again.** |

### 5.2.5 Lifting points

Lifting points, if available, are marked with a sticker.



| | |
|---|---|
| **WARNING** | **Make sure that the lifting devices are properly fastened. Deficient fastening may cause devices to slip causing the load to become unbalanced and fall, which could result in serious damage, injury or death.** |

## 5.3 Electrical connections

| | |
|---|---|
| | **Only qualified electrician shall make any electrical connections.** |

| | |
|---|---|
| | **Electrical connections shall be made according to wiring diagrams provided with the product.** |

| | |
|---|---|
| **WARNING** | **Power supply shall be OFF and locked before making any electrical connections. Lockout-tagout procedures must be followed in accordance with local regulations. Refer to chapter "Lockout - Tagout procedure".** |

Carry out the following procedures BEFORE connecting the hoist to the mains network:

| | |
|---|---|
| **1** | Check that the rated voltages correspond to the main voltage.<br>Voltages and frequencies marked on the data plate of motors driven by inverter can deviate from the values on the data plate for the hoist. |
| **2** | Check that the power supply to the hoist is protected with fuses of the correct size. |
| **3** | Check that the phase sequence is correct. |
| **4** | Check carefully all the connections.Refer to torgue chart. |

Connect the hoist to the power supply.

| | |
|---|---|
| ⚠ | **Before installation the instructions in chapter *"Safety first"* shall be read.** |

| | |
|---|---|
| ⚠ | **The installation procedure requires special skills and tools to ensure safe and reliable operation of the product. Installation work shall be carried out only by authorized service personnel or an experienced service technician authorized by the manufacturer or manufacturer's representative.** |



**Note:** Installation instructions can be found from the separate "Installation and

# 6 COMMISSIONING

Before handing over the hoist, at least the inspections and adjustments listed in this chapter shall be carried out. The scope of the inspection depends on the operating range and application. In some cases it is appropriate to carry out a more thorough inspection.

| | |
|---|---|
| ⚠ | **Product shall not be used before proper commissioning.** |

**Note:** Commissioning procedure requires special skills and tools to ensure safe and reliable operation of the product. Commissioning shall be carried out only by authorized service personnel or an experienced service technician authorized by the manufacturer or manufacturer's representative.

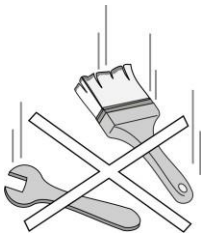
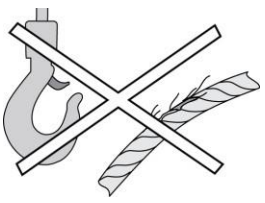
| | |
|---|---|
| ⚠ | **Before commissioning the instructions in chapter *"Safety first"* shall be read.** |

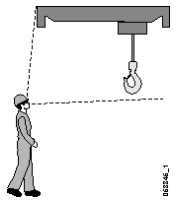
| | |
|---|---|
| ⚠ **CAUTION** | **Any defects or abnormalities which are detected during the commissioning must be investigated and corrected in accordance with the instructions relevant to component in question.** |

| | |
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| **NOTICE** | Local requirements may demand other commissioning testing to be performed before product can be take into use. Make sure all the local requirements are fulfilled. |

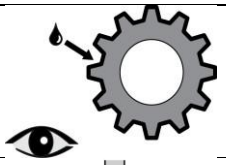
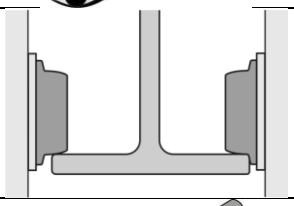
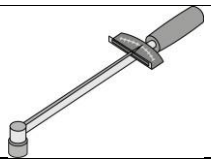
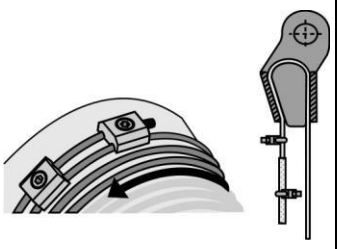
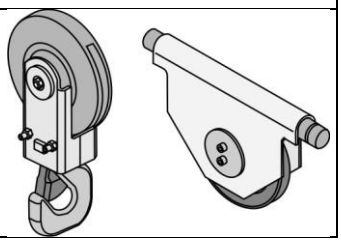
## 6.1 Commissioning preparations

| | |
|---|---|
| ⚠ | **During installation, commission and maintenance, lockout-tagout procedures must be followed in accordance with local regulations and the documented site lockout-tagout policy. Refer to chapter "Lockout - Tagout procedure".** |

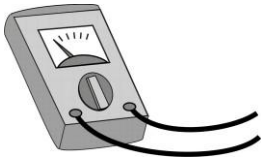
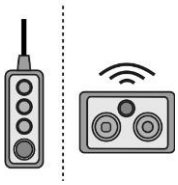
| | | |
|---|---|---|
| **1** | **Loose items**<br><br>Check that there are no hazards from loose items.<br><br>Items which are not properly secured to the product, such as tools or detached components, could move or fall accidentally, with potentially serious consequences. |  |
| **2** | **Damaged parts**<br><br>Note any damaged parts from installers or in shipping. |  |

| | | |
|---|---|---|
| 3 | **Clean environment**<br><br>Check that no permanent or temporary obstructions are in the way of the hoist when the hoist is operated. |  |

## 6.2 Checks before first run

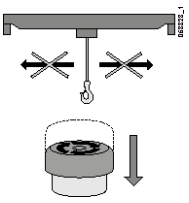
| | | |
|---|---|---|
| 1 | **Lubrication**<br>Check the lubrication of the travelling and hoisting gear. Check all gear boxes are vented. |  |
| 2 | **Installation**<br>Check the trolley is properly mounted on the track. |  |
| 3 | **Bolted connections**<br>Check bolted connections. Bolts need to be torqued with proper torque wrench. Check installation of jam and locking nuts. Refer to chapter "Tightening torques". |  |
| 4 | **Electrical connection**<br>Check that the connections of electrical devices comply with the wiring diagrams and meet local requirements. In particular, check connections that affect safety and control of the hoist. Check the condition of wiring and connections.<br>Product disconnect OFF, check the proper electrical grounding of the product. Follow the recommended grounding practices. Do not allow any of the product structure or components to be used for grounding. |  |
| 5 | **Wire rope**<br>Check that the rope has not been damaged in transport. Check that the rope is correctly reeved.<br>Check that wire rope is properly installed on the drum. Make sure that rope is tight around the drum and through the rope guide. Check rope clamp fastenings and fastening torques.<br>Check the fixing of rope ends. Note the correct position of the wedge housing. Check that stick out on the dead end of the rope and that the dead end clamps are installed. |  |
| 6 | **Hook and rope sheaves**<br>Check operation and condition of the hook and safety latch. Check that the hook forging is rotating freely. Check condition of sheave covers. Check that the rope sheaves are rotating freely.<br>Check the general outlook of the coating in case of bronze coated hooks. |  |

## 6.3 Test run without load

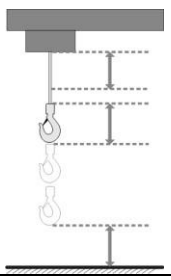
| | | |
|---|---|---|
| 1 | **Electrical connections**<br>Check the cableways for electrical wiring. Make sure that wires do not snag on structures when the hoist is moving.<br>Check that the rated voltages correspond to the main voltage. Check that the power supply to the hoist is protected with fuses of the correct size. Check that the phase sequence is correct.<br>The voltages and frequencies marked on the data plate of motors driven by inverter can deviate from the values on the data plate for the hoist.<br>Check possible fault messages from hoist control device and inverters (not in all models) |  |
| 2 | **Controller**<br>Check that the controller is correctly installed and in good condition. Controller shall not cause any disturbance for other controllers. Check the functionality of push buttons, joysticks and switches.<br>Check that all motions occur to the correct direction. Make sure that desired functions operates from the correct push button, joystick or switch.<br>Charge the batteries for optional controllers before using. |  |

| | |
|---|---|
| **CAUTION** | **Always press UP direction when checking lifting/lowering motion for the first time or after repairs. See phasing instructions.** |

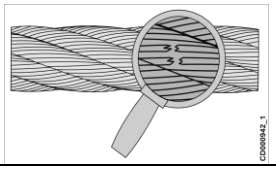
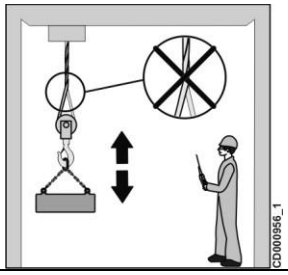
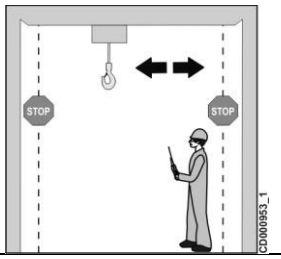
| | |
|---|---|
| **NOTICE** | Check the resultant motion by pressing first the UP direction button even though the hook is near the upper stop limit. |

| | | |
|---|---|---|
| 3 | **Emergency stop button**<br>Check the operation and condition of the emergency stop button without the equipment moving. |  |

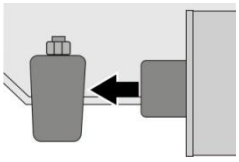
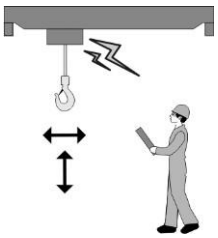
| | |
|---|---|
| **NOTICE** | Only use the emergency stop button to stop movement in the event of a product malfunction or other emergency situation. Using the emergency stop button can cause the load to swing unexpectedly. |

| | | |
|---|---|---|
| 4 | **Hoisting limit switches**<br>Install and adjust the ultimate hoisting limit switch, if available. The ultimate hoisting limit switch shall always be installed above all the other limits.<br>Check the operation of optional hoisting limits.<br>After adjusting hoisting limits, commissioning for hoisting inverter (not in all models) shall be made. |  |

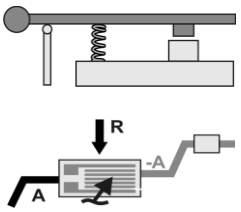
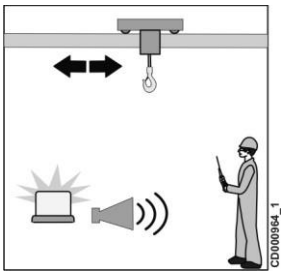
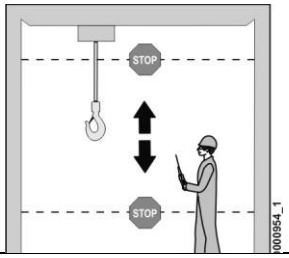
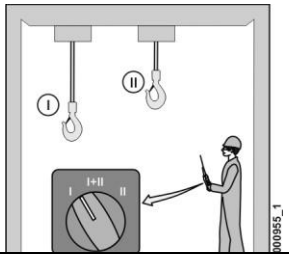
| | |
|---|---|
| ⚠ | **Hoisting limit switch shall always be adjusted before the commissioning tests can be continued.** |

| | | |
|---|---|---|
| **5** | **Wire rope test drive**<br>Carry out rope test drive. Visually check for broken wires / kinks and any other damage. Refer to appendix “Criteria for Inspecting and discarding wire ropes”. |  |
| **6** | **Wire rope**<br>New wire rope shall be taken in use by a load, which is of approx. 10 % of the nominal load. This load shall be lifted to the total lifting height 5 – 10 times.<br>**Make sure that the hook will not turn around while lifting.** |  |
| **7** | **Traveling limit switch (not in all models)**<br>Check that traveling limit switches are in the center-position before driving against the trigger. Adjust the triggering locations of the traveling limit switch. Check the operation of the limit switch.<br>After adjusting traveling limits, start up for traveling inverter (not in all models) shall be made. Check that control method for traveling is correct. |  |

| | |
|---|---|
| ⚠ | **Traveling limit switches shall always be adjusted before the commissioning tests can be continued.** |

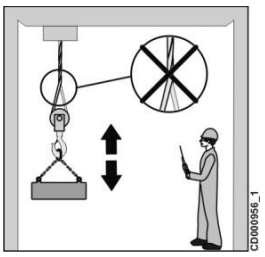
| | | |
|---|---|---|
| **8** | **Buffers and buffer stops**<br>Driving low speed, check that the buffer hits center of the buffer stop. Check that the hoist buffers are able to bump into the runway end stops or buffers of other trolley |  |
| **9** | **Operating sound and movements**<br>Listen the operating sound when product is hoisting or traveling. Pay attention to unusual noises, for example, squeals.<br>Check that the hoist is running smoothly. No evident vibration shall be observed. |  |

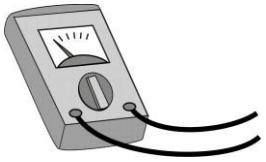
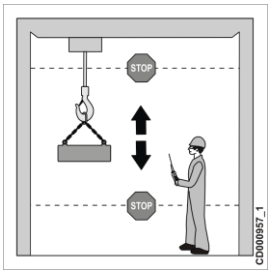
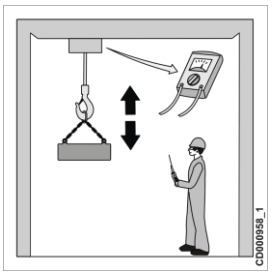
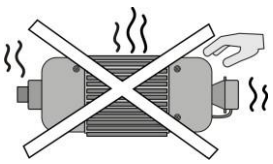
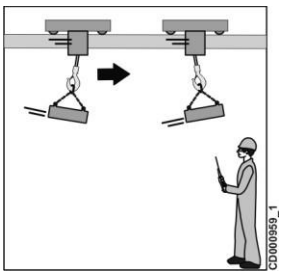
| | |
|---|---|
| ⚠ **CAUTION** | **Any defects or abnormalities which are detected during the commissioning must be investigated and corrected in accordance with the instructions relevant to component in question.** |

| | | |
|---|---|---|
| 10 | **Overload protection**<br>Check that the overload protection mechanism operates correctly.<br>Check that the rope anchorage and support beam move freely.<br>In case there is an electrical overload device and hoist control device is located to the bridge panel, make sure that calibration values are entered in hoist control device. |  |
| 11 | **Trolley**<br>Run the trolley at least 3…5 times over the whole length of the girder.<br>Check that the trolley moves smoothly. Check that the wheelbase of the trolley is correctly adjusted. Check the tightening and locking of all screws for trolley adjustment.<br>Check that warning indication for traveling movements works as ordered. |  |
| 12 | **Brake operation**<br>Check that the hoisting brake operates correctly in both up and down directions. |  |
| 13 | **Hoist selection**<br>Check that the hoist selection is functioning. |  |

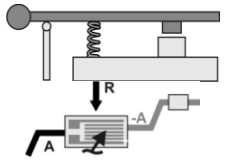
## 6.4 Test run with test load

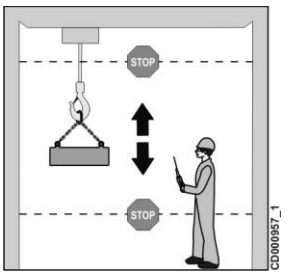
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|---|---|
| ⚠ | **Test load shall be securely fastened and properly balanced.** |

| | | |
|---|---|---|
| 1 | **Wire rope**<br>New wire rope shall be taken in use by a load, which is of approx. 10 % of the nominal load. This load shall be lifted to the total lifting height 5 – 10 times.<br>Make sure that the hook will not turn around while lifting. |  |

| | | |
|---|---|---|
| 2 | **Power supply measurements**<br>Check that voltage is over required minimum value under 100% load. It is recommended to record the voltages phase to phase and phase to ground at the power coming to the hoist. |  |
| 3 | **Brake operation**<br>Check that the brake is able to stop the motion adequately. |  |
| 4 | **Motor current**<br>Check the motor current in each phase during hoisting motion with rated load. The current should be in balance in all phases and may not exceed the ratings for the motor. |  |
| 5 | **Running temperature**<br>If the thermal protection halts hoisting prematurely, identify the reason for overheating before continuing the commissioning tests. |  |
| 6 | **Traveling machinery**<br>Check that the acceleration and braking motions operate smoothly.<br>Run the trolley at least 3…5 times over the whole length of the girder.<br>Remove the paint coming loose from the runway of the trolley. |  |

## 6.5 Test run with 110…125% overload

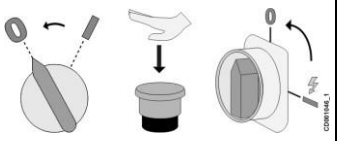
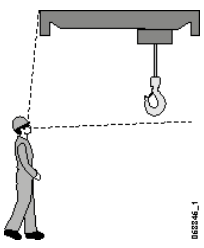
| | | |
|---|---|---|
| 1 | **Overload protection**<br>Check that the overload protection operates with an over 110% overload. In case overload protection is done by hoist power measurement, calibration shall be made. |  |

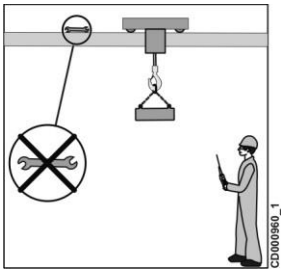
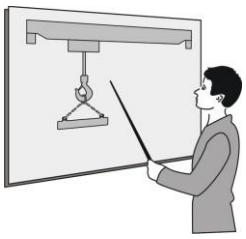
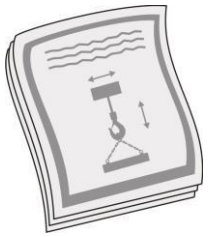
| | | |
|---|---|---|
| 2 | **Brake operation**<br>Check that the brake is able to stop the motion adequately. |  |
| 3 | **Wire rope fastenings**<br>Check that the rope has not slipped in the rope anchorage by comparing the measures with the stated measures in the table.<br>Check torgue of bolts, refer to chapter “Tightening torques”. |  |

| | |
|---|---|
| **NOTICE** | Local requirements may demand other commissioning testing to be performed before product can be take in to use. Make sure all the local requirements are fulfilled. |

| | |
|---|---|
| ⚠ | **All optional features shall be tested before using the product.** |

## 6.6 After test runs

| | | |
|---|---|---|
| 1 | **Turn all controllers and main switches off**<br>All controllers and main isolation switches must be placed in the off position. |  |
| 2 | **Rope installation**<br>Check that the rope has not slipped in the rope anchorage |  |
| 3 | **Visual check**<br>Check visually that hoist or any other part has not damaged in any way during commission testing. |  |

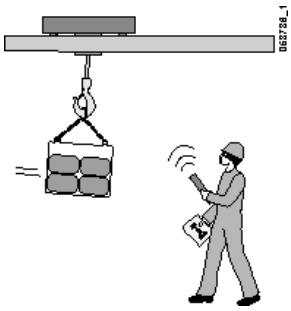
| | | |
|---|---|---|
| 4 | **Cleaning**<br>Check that all tools and materials used during installation are removed from the hoist and track. |  |
| 5 | **User training**<br>Ensure that the hoist operator and supervision personnel are aware of the need for user training.<br>The authorized service organization of the hoist manufacturer can arrange user training by separate agreement |  |
| 6 | **Handover documents**<br>Check the documents delivered with the hoist. Ensure that entries in the documents are properly recorded and that the reference data in the documentation matches that on the type rating plates. |  |

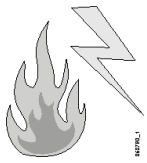
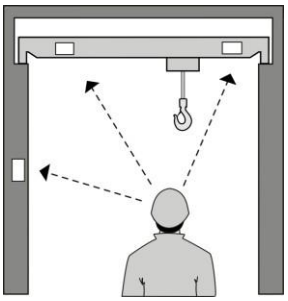
| | |
|---|---|
| **WARNING** | **Make sure that the lifting devices are properly fastened. Deficient fastening may cause devices to slip causing the load to become unbalanced and fall, which could result in serious damage, injury or death.** |

## 6.7 INSTRUCTIONS FOR THE ASSEMBLER

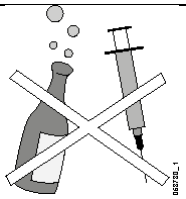
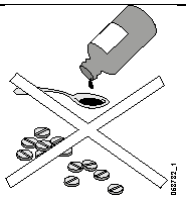
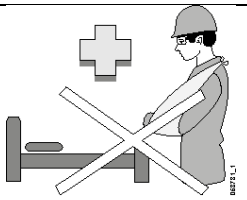
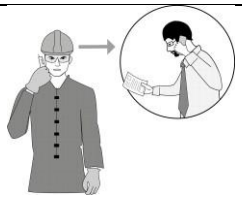
| | |
|---|---|
| **WARNING** | **Only Authorized Personnel and Qualified Personnel shall be permitted to assemble the equipment and, when doing so, they must strictly adhere to the instructions and warnings provided in this manual.** |

**Assemblers SHALL:**

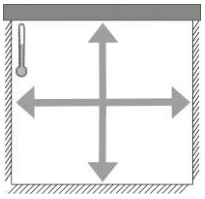
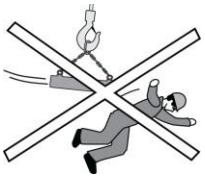
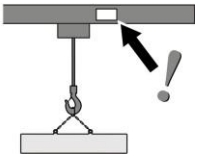
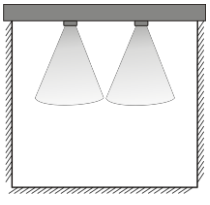
| | | |
|---|---|---|
| 1 | Assemblers SHALL be trained and be competent for the task. |  |
| 2 | Assemblers SHALL learn how to assemble the hoist safely before actually starting to work on the hoist. | |
| 3 | Assemblers SHALL know all the basic controls of the hoist and must be able to use them correctly and safely for the purpose of functional testing.<br>Assemblers can use the hoist **Owner's manual** to familiarize themselves with the equipment and equipment controls. |  |

| | | |
|---|---|---|
| **4** | Assemblers SHALL be aware of any risk of accident posed by the assembly site. |  |
| **5** | Assemblers SHALL familiarize themselves with the signs and warnings marked on the product. |  |
| **6** | Assemblers SHALL always follow the local regulations. |  |

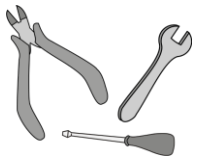
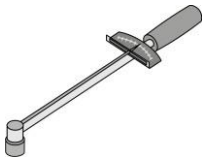
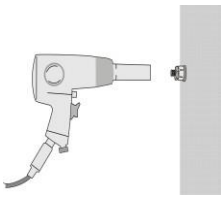
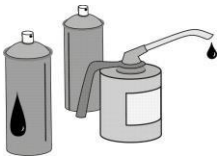
**Assemblers SHALL NOT:**

| | | |
|---|---|---|
| **1** | Assemblers SHALL NOT work on the equipment when under the influence of alcohol or drugs. Alcohol and drugs can impair judgment and thereby cause a hazard. |  |
| **2** | Assemblers SHALL NOT work on the equipment when under medication which may cause a hazard to the assembler or others. If unsure, consult your doctor or pharmacist. Always comply with local regulations regarding working under the influence of medication. |  |
| **3** | Assemblers SHALL NOT work on the equipment while suffering from any illness or injury which might impair their ability to properly construct the equipment. |  |
| **4** | Assemblers SHALL NOT substitute parts (for example, missing items) with items sourced locally without approval. Locally sourced parts may not meet the required specification and substituted parts could present a variety of safety hazards.<br>Contact a service agent authorized by the manufacturer immediately in case of doubts! |  |

## 6.8 Assembly environment requirements

| | | |
|---|---|---|
| 1 | **Indoor assembly space**<br>The assembly site must be sufficiently spacious and clear to permit the construction of the equipment. Floors must be level and the assembly site should present no avoidable hazards to the assembler. |  |
| 2 | **Prevent unauthorized access to the site**<br>Unauthorized persons and bystanders must be prevented from walking on or below the work site.<br>Ensure that the secured area is spacious enough to prevent injuries which could occur as a result of falling components or tools. |  |
| 3 | **Minimize the risks of moving machinery**<br>Make sure that there is no possibility for personnel or body parts to be struck, crushed or compressed by moving machinery.<br>The area must be secured so that installation personnel are not at risk from the movements of machines, automatic doors or adjacent cranes at the installation site. Ensure that machinery and equipment cannot start up accidentally and cannot move during installation. Maintain sufficient space in the working area to reduce the risks.<br>Moving parts should be properly shielded with guards to prevent entrapment. Safety devices must never be overridden.<br>Be prepared in case equipment moves in the wrong direction during testing. |  |
| 4 | **Power supply**<br>The assembled equipment will be tested with electricity connected.<br>Never connect power before ensuring that you have the correct voltages, phases and current ratings available for each equipment. |  |
| 5 | **Lifting facilities**<br>The assembled equipment is a very heavy item which itself must be erected using a fixed or mobile crane. Make sure that a suitable crane is available and that it is capable of lifting the total weight of the equipment assembly. |  |
| 6 | **Lighting**<br>Make sure that you have good lighting around the assembly site. Some measurements must be made during assembly and it is important that you can see properly so that these are made correctly. |  |

## 6.9 Tool requirements

| | | |
|---|---|---|
| **1** | **General workshop tools**<br>Standard general tools such as screwdrivers, cutters and hacksaws are required during the assembly process. |  |
| **2** | **Torque wrench**<br>Fastenings must be tightened to the specified torque. |  |
| **3** | **Painting equipment**<br>The equipment may require painting or touching up as part of the assembly process. |  |
| **4** | **Heat gun for heat-shrink sleeves**<br>If it is necessary to terminate the cables during assembly, a suitable heat gun will usually be needed to shrink the heat-shrink sleeves. |  |
| **5** | **Multimeter**<br>Normally no electrical fault-finding is required but a multimeter is possibly required during the functional testing. |  |
| **6** | **Power tools**<br>It is useful to have a range of electric or compressed air power tools available. These can include drills and powered wrenches for tightening fastenings.<br>If using compressed air, follow the correct procedures and be aware of the safety risks. |  |
| **7** | **Lubricants**<br>Some lubricants such as cutting oil will sometimes be useful while assembling. Follow applicable safety guidelines for handling and storing lubricants. |  |

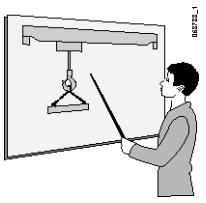
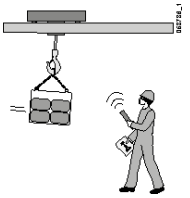
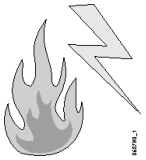
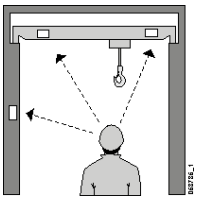
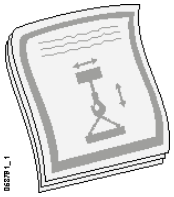
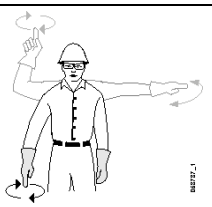
# 7 INSTRUCTIONS FOR THE OPERATOR

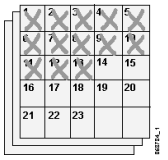
## 7.1 Operator's Responsibilities

Hoists are used for various purposes, handle different types of loads and are operated different ways by many operators. Many workers, as part of their regular job responsibilities, normally operate hoists as non-dedicated operators.
Because the manufacturer of the hoist has no direct involvement or control over the hoist's operation and application, conforming to good safety practices is the responsibility of the owner, and the equipment's operating personnel. Only those **Authorized Personnel** and **Qualified Personnel** who can demonstrate that they have read and understood this manual and that they understand the proper operation and maintenance of the product should be permitted to work with it.

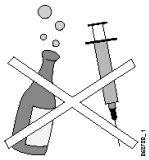
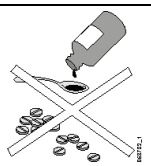
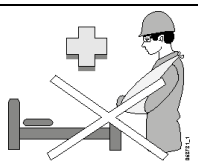
| | |
|---|---|
| **CAUTION** | **Failure to adhere to the instructions and warnings provided in this manual can result in serious injury or death.** |

**Operators SHALL:**

| | | |
|---|---|---|
| **1** | Operators SHALL be trained by the owner of the equipment or a qualified designee and be competent for the task. |  |
| **2** | Operators SHALL learn how to operate the equipment safely before actually starting to work with it. | |
| **3** | Operators SHALL know all the controls and must be able to use them correctly and safely. |  |
| **4** | Operators SHALL learn how to control the movements of the hook and load. | |
| **5** | Operators SHALL be aware of any risk of accident posed by the operating site. |  |
| **6** | Operators SHALL familiarize themselves with the signs and warnings marked on the equipment. |  |
| **7** | Operators SHALL use this manual to familiarize themselves with the equipment and equipment's controls. |  |
| **8** | Operators SHALL learn the hand signals for directing equipment's movements. |  |

| | | |
|---|---|---|
| **9** | Operators SHALL be familiar with proper rigging procedures. |  |
| **10** | Operators SHALL carry out daily inspections |  |
| **11** | Always follow the local regulations. |  |

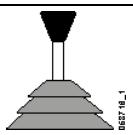
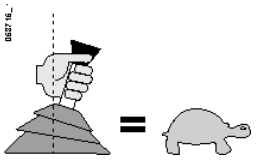
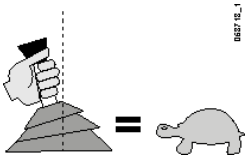
**Operators SHALL NOT:**

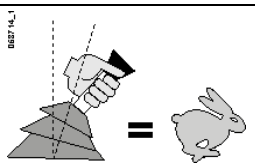
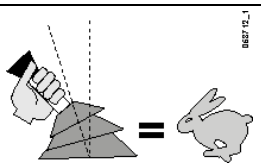
| | | |
|---|---|---|
| **1** | Operators SHALL NOT operate the equipment when under the influence of alcohol or drugs. Alcohol and drugs can impair judgment and thereby cause a hazard. |  |
| **2** | Operators SHALL NOT operate the equipment when under medication which may cause a hazard to the operator or others. If unsure, consult your doctor or pharmacist. Always comply with local regulations regarding working under the influence of medication. |  |
| **3** | Operators SHALL NOT operate the equipment while suffering from any illness or injury which might impair their ability to properly use the equipment. |  |

## 7.2 Control devices and their location

### 7.2.1 Controls for Movements

The speed corresponds to the position of the direction control. Equipment moves at the slowest speed when the joystick is partially pushed and at the maximum speed when the joystick is fully pushed. Equipment stops moving when the joystick is released.

| | | | |
|---|---|---|---|
| **1** | When the joystick is released the equipment will stop moving. |  | |
| **2** | When the joystick is partially pressed, the equipment will move at a slow speed. |  |  |

| | | | |
|---|---|---|---|
| **3** | When the joystick is fully pressed, the equipment will accelerate up to the maximum speed. |  |  |

**Note:** Sudden speed changes increase wear on motors and brakes.

## 7.2.2 Controller

The layout of controls may vary from product to product. The function of each control is indicated by a symbol and it is important that the operator knows what the symbols mean in order to operate the equipment safely.

| | |
|---|---|
| **WARNING** | **Operating the radio transmitter with a low battery can result in sudden loss of control and hazardous situations. Charge the battery promptly if the low battery lamp is lit on the radio transmitter.** |

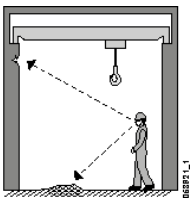
## 7.3 Checks to Be Done Before Every Working Shift

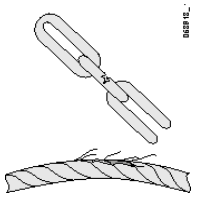
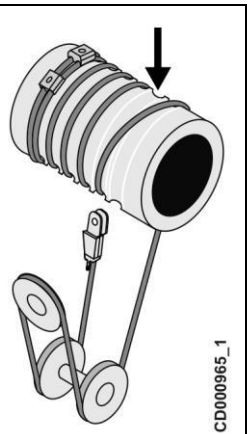
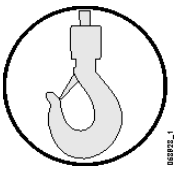
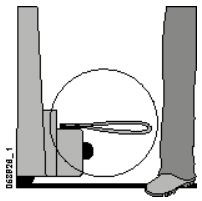
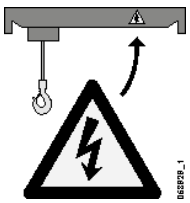
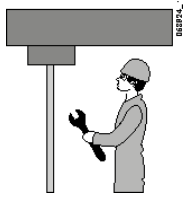
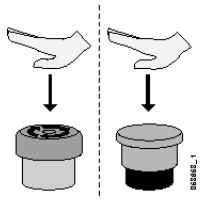
Before every working shift, the operator SHALL make the following checks to ensure that the product is in a safe operating condition. By carrying out these simple checks, the operator can identify potential problems at any early stage, thereby enhancing safety and minimizing down time.

| | |
|---|---|
| **NOTICE** | If any abnormal condition or malfunction is noted on the daily inspection or occurs during daily operation, report it to the supervisor immediately and remove the product from use. Operation may only continue when safe operation is ensured. |

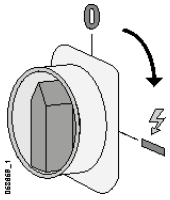
| | |
|---|---|
| **WARNING** | **Operating a product with an abnormal condition or malfunction can result in serious injury or death or serious damage to the product.** |

## 7.3.1 Checks to Be Performed by the Operator

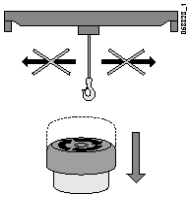
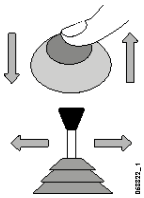
| | | | | | |
|---|---|---|---|---|---|
| **1** | Visually check the operating environment to make sure that there are no new hazards which might prevent safe use. |  | **2** | Visually check to see if there are any oil leaks from the product. |  |

| | | | | | |
|---|---|---|---|---|---|
| **3** | Visually check the ropes or chains for any deformation or damage (for example, broken wires, broken strands, kinks). For more details, refer to *Appendix: Criteria for inspecting and discarding wire ropes.* |  | **4** | Visually check the rope reeving. The ropes should all be properly seated in the grooves of the rope drum and rope sheaves. Check that rope is not twisted and that the ropes are not touching each other. |  |
| **5** | Inspect the hook for nicks, gouges, deformation of the throat opening, and wear on saddle or load bearing point. Check that safety latch is working properly. Check free rotation of hook forging. |  | **6** | Verify that all safety guards are in place. |  |
| **7** | Check that all warning signs are in place, in good condition, and can be read easily. See chapter *Signs*. |  | **8** | Verify that nobody is doing maintenance work on the product. |  |
| **9** | Check that the product is not locked or tagged out. Follow local safety procedures. |  | **10** | Check that the emergency stop button is working properly. |  |

## 7.3.2 Operational Checks with the Emergency Stop Button Pushed Down

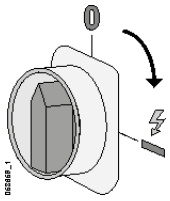
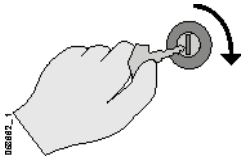
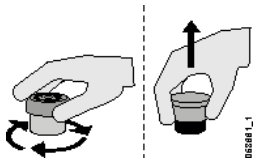
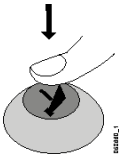
| | | |
|---|---|---|
| **1** | Turn on the main power isolation switch.<br>After the main isolation switch has been turned on, the product becomes operational (energized). |  |

| | |
|---|---|
| **WARNING** | **If the emergency stop button is faulty, the product might move unexpectedly during the following checks. Unexpected movements during checks could result in death or serious injury.** |

| | | |
|---|---|---|
| **2** | **Emergency stop button**<br>With the emergency stop button pressed down, check that the product does not move when the direction control pushbuttons are pressed. This verifies that the emergency stop button is working properly. |  |
| **3** | **Control devices without power**<br>Check for smooth mechanical operation of each pushbutton, joystick or safety switch on the **controller**. |  |

## 7.3.3 Controller Set Up

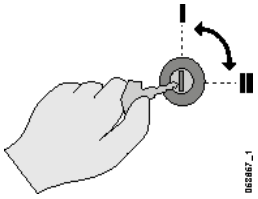
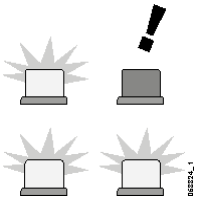
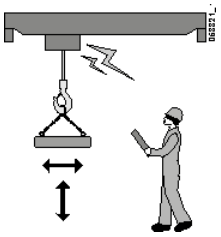
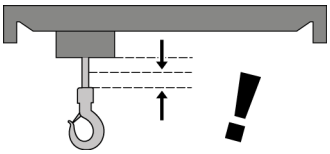
| | |
|---|---|
| **WARNING** | **Never release the emergency stop button and drive the product until you are sure that it is safe to do so. Releasing the emergency stop button and driving the product when it is unsafe to do so could cause death or serious injury.** |

| | | |
|---|---|---|
| **1** | Make sure that the main power isolation switch is ON.<br>The product only becomes operational (energized) after the necessary steps have been followed to established communication between the product and controller. |  |
| **2** | If applicable, use the key switch to turn on the **controller**. |  |
| **3** | To prepare the **controller** for operation, release the emergency stop button by turning it clockwise (or, if it is a push-pull button, by lifting it up) so that it is in the raised position. |  |
| **4** | Energize the product by pressing the start pushbutton (if available). |  |

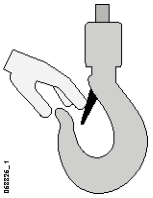
Now the **controller** is ready for operational checks.

## 7.3.4 Operational Checks with Controller Enabled

Before every working shift, all of these checks must be done with the emergency stop button released and with the power turned on.

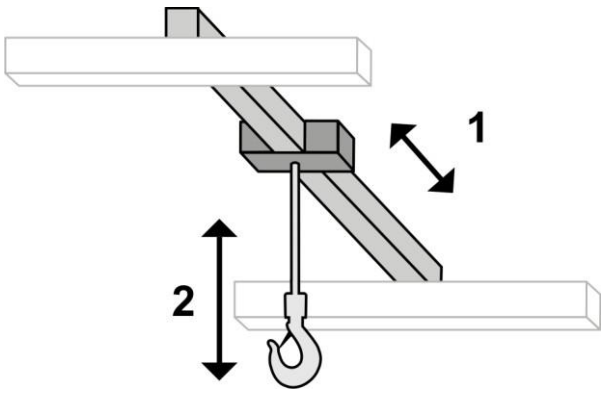
| | | |
|---|---|---|
| 1 | **Equipment selection**<br>If the **controller** has an equipment selection switch, select the correct equipment before carrying out these checks. |  |
| 2 | **Warning devices**<br>Check that all warning devices (for example, pilot lamps, LEDs, displays, horns, gongs, bells, sirens, beacons, strobe lights) are working correctly before using the equipment. |  |
| 3 | **Control devices with power**<br>Starting at low speed, check that movements correspond to the **controller** labels. Check that the brakes operate in all directions and that speed increases as it should do in relation to the control. Listen for unusual noises. |  |
| 4 | **Upper stop limit**<br>Check for correct operation of the upper stop limit by raising the hook up and stopping it before the limit switch activates. Slowly inch the hook up until the limit switch activates and prevents further upward movement. |  |

| | |
|---|---|
| **CAUTION** | **Do not run the block into the frame or drum. Running the block into the frame or drum could cause damage or injury.** |

| | | |
|---|---|---|
| 5 | **Safety latch**<br>Check to ensure that the hook safety latch is on the hook, is in good condition and closes automatically. |  |

| | |
|---|---|
| **NOTICE** | The radio remote controller only works when it contains a battery which is adequately charged. |

## 7.4 Movements



The hoist moves in the following directions:

| Movements | Description |
|---|---|
| 1. Trolley movements | Horizontal movements of the trolley |
| 2. Hoist movements | Vertical up and down movements of the lifting |

**Essential pre-requisites for this chapter**

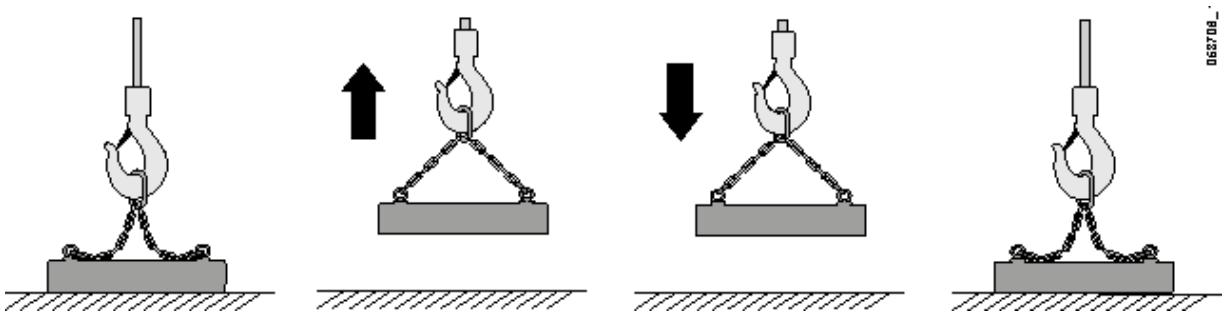
| | |
|---|---|
| **WARNING** | **When operating the product, make sure that there are no people situated underneath or nearby the load. Operating the product when people are underneath or near the load could cause death or serious injury.** |
| **NOTICE** | Do not deliberately use limit switches to stop the motion. Always stop the motion by using the control devices on the controller. |
| **NOTICE** | If the controller has a hoist or crane selection switch, be sure to select the correct hoist or crane before operating. |
| **NOTICE** | If the product malfunctions during use, push the emergency stop button and contact the supervisor. |

## 7.4.1 Motor Control Methods

The components are controlled by a variety of electrical circuits called “drive circuits”. The motors can all be driven by the same type of drive circuits or a mixture of types.

**Note:** Sudden speed changes increase wear on motors and

## 7.4.2 Lifting and Lowering Motions



**Before lifting**
After securely attaching the load to the lifting device, the hoisting machinery must be correctly positioned and attached to perform the lift. The following steps must be followed before lifting.

| | |
|---|---|
| **WARNING** | **Moving a load that is not properly attached to the lifting device could cause death or serious injury.** |

**Note:** Do not attempt to lift a load which is fastened to the ground or to a base which will prevent it from being lifted.

The product is fitted with the following devices which work in conjunction with lifting and lowering movements:

## 7.5 Load Handling

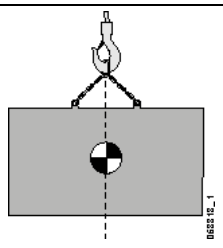
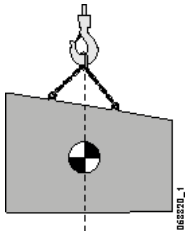
Correct load handling allows the operator to move loads quickly and safely.

| | |
|---|---|
| **WARNING** | **Handle the load safely at all times. During movements, ensure that the hook, the load, the product and its moving parts will not collide with objects or people. Failure to do so could cause death or serious injury.** |

Evaluating the load
To prevent overloading, the operator shall determine the weight of the load before lifting. The operator shall only lift the load when he or she is sure that it weighs no more than the permitted load of the product and accessories. The product's overload device shall not be used to determine whether the load can be lifted.
Never attempt to lift a load that weighs more than the maximum permitted load of the equipment and accessories.

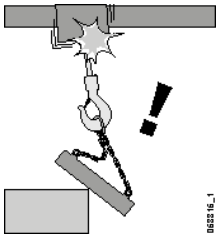
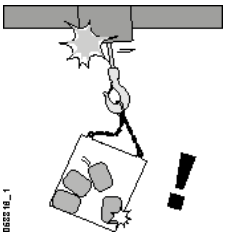
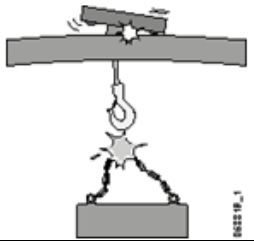
| | |
|---|---|
| **CAUTION** | **Attempting to lift a load that weighs more than the maximum permitted load of the equipment and accessories could cause death or serious injury.** |

**Balancing the load**
The hook, slings and harnesses must be positioned so that the pulling force of the product lies on the load's center of gravity so that the load is balanced. When the operator begins to hoist a load, he or she shall check that it is properly balanced before lifting it high off the ground. If the load is not balanced, lower it down and adjust the lifting point.

| | | |
|---|---|---|
| **1** | **Lifting centrally balanced loads**<br>The center of gravity will usually be in line with the center of the load.<br>Provided that the contents of the container cannot move around, the balance of the load stays the same. |  |
| **2** | **Lifting off-center balanced loads**<br>The center of gravity of an off-center balanced load will usually be towards the heavier end of the load.<br>Provided that the contents of the container cannot move around, the balance of the load stays the same. |  |

| | |
|---|---|
| **WARNING** | **Never try to balance an unbalanced load with your hands. Lower the load and adjust the lifting point. Trying to balance an unbalanced load with your hands could cause death or serious injury.** |

Shock loading
The product and accessories are designed to take up the weight of loads gradually and steadily. They are not designed to withstand sudden increases or decreases in the apparent weight of the load. Shock loading can occur in any situation where the load on the product suddenly increases or decreases. Some examples of how shock loading can occur are shown below.

| | | |
|---|---|---|
| **1** | **Change of load balance**<br>A change in load balance can suddenly pull on the hoisting rope. |  |
| **2** | **Unstable load**<br>If the load is unstable, it can exert sudden force on the hoisting rope.<br>The contents of packing cases should be securely fastened so that they cannot move around during lifting. |  |
| **3** | **Rapid load reduction**<br>A sudden loss of the load can cause the **trolley/hoist** to jump. |  |

| | |
|---|---|
| **NOTICE** | Avoid shock loading the product. Shock loading the product could damage the product or the load. |

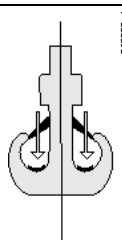
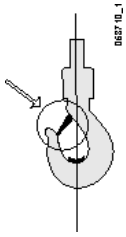
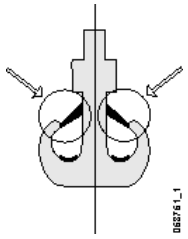
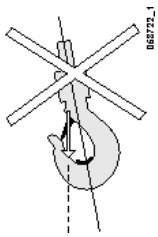
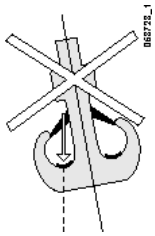
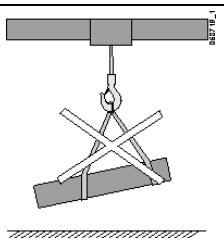
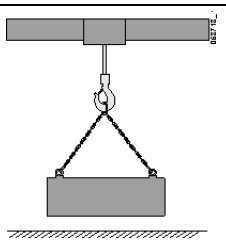
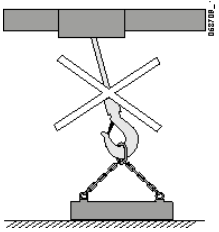
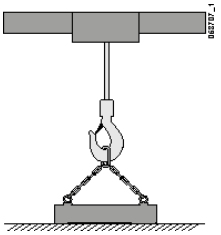
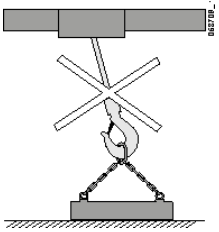
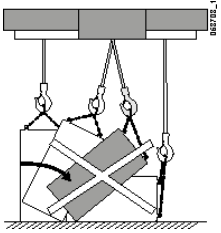
| | |
|---|---|
| **CAUTION** | **After a shock load equipment shall not be used before authorized service personnel or an experienced service technician authorized by the manufacturer or manufacturer's representative has determined that the equipment is safe to use. The usage of a defective product can result in serious damage, injury or death.** |

Attaching the load
The load is usually attached to the product by means of some kind of under-the-hook lifting device. The most common under-the-hook lifting devices are chains, wire rope slings and lifting belts. The operator shall select a lifting device designed for the product being transported.

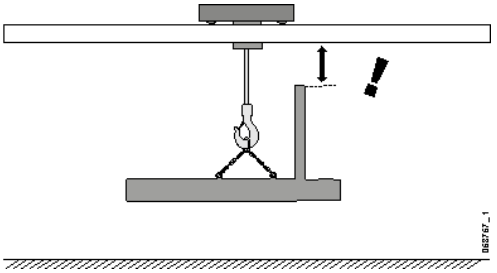
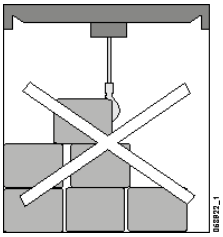
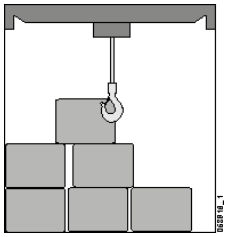
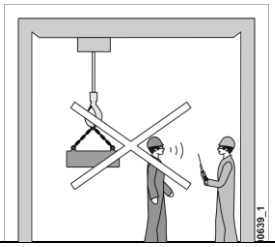
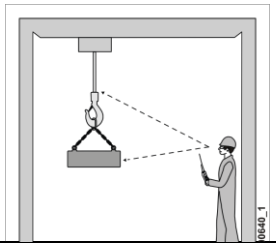
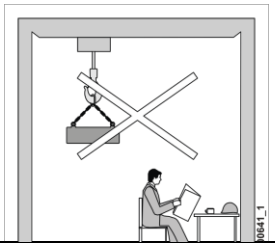
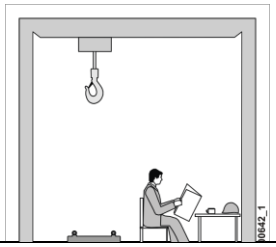
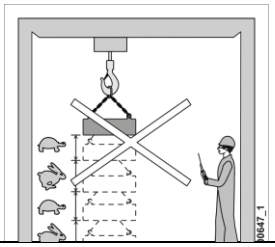
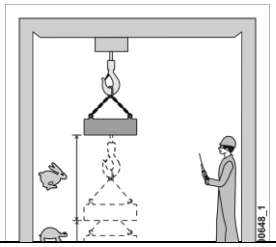
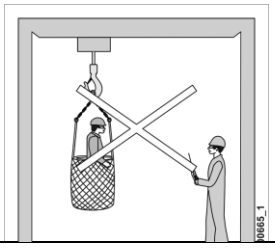
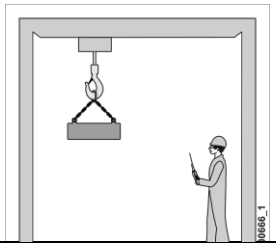
| | |
|---|---|
| | **Always follow instructions provided by the lifting device manufacturer when using under-the-hook lifting devices. Never use the product's ropes or chains as a sling to attach to the load.** |

**Lockable hook**
If a lockable hook block is used, it is possible to lock the hook forging in steps of 90 degrees, to prevent load handling problems caused by rotating the load.

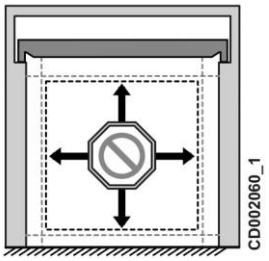
**Load handling**

| | | | |
|---|---|---|---|
| **1** | To avoid damaging the hook, lifting devices must only be positioned on the load bearing surface of the hook. That is, the lowest point of the hook. Forces on ramshorn hooks must be equal on both load bearing surfaces. |  |  |
| **2** | Ensure that the hook safety latches are closed. Check that the safety latch is not subjected to any force by the load. |  |  |
| **3** | The weight of the load must be centered on the center line of the hook forging so that the load does not bend the neck of the hook. Never try to lift anything with the tip of the hook! |  |  |
| **4** | Check that the load is balanced and safely fastened at the lifting points. The load must not be able to slide, slip or detach itself when suspended. |  |  |
| **5** | The **hoist** must be positioned directly above (perpendicular to) the load so that there are no side-pulling forces. |  |  |
| **6** | Do not drag the load along the ground. |  |  |

| | |
|---|---|
| **NOTICE** | Never drag loads or pull loads from the side. |

| | | |
|---|---|---|
| **7** | The operator shall ensure that the product or the load does not collide with anything or fall from the lifting device. |  |
| **8** | Check that you have a clear view from the **controller** position. Remove any visual obstructions. |   |
| **9** | **Do not divert attention from the load while operating the product.** |   |
| **10** | **Never leave the load hanging on the hook unattended.** |   |
| **11** | **Avoid short, jerky motions. Unnecessary short starts cause the hoisting motor to overheat quickly. Do not switch the controller back and forth unnecessarily because it causes wear.** |   |
| **12** | **The product is designed for lifting and transporting material only.** |   |

| | |
|---|---|
| **WARNING** | **Never use the equipment for lifting or transporting people. Lifting or transporting people could cause serious injury or death.** |

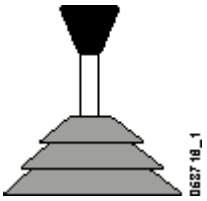
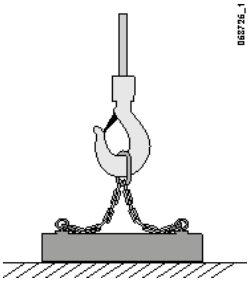
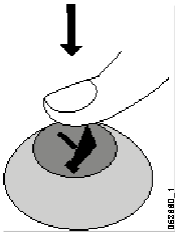
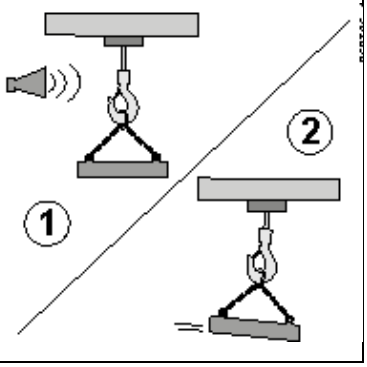
| | | |
|---|---|---|
| **13** | Stop all hoisting and travelling motions before the safety limit switches. |   |

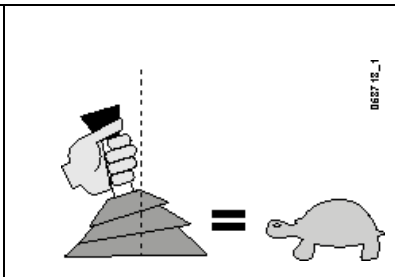
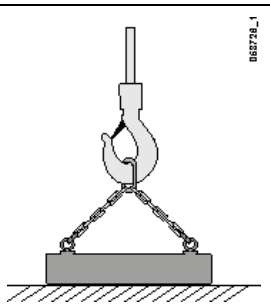
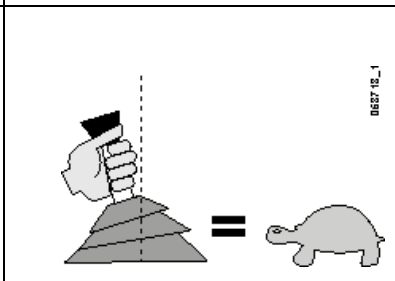
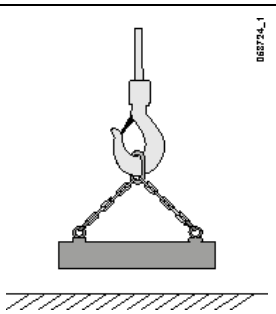
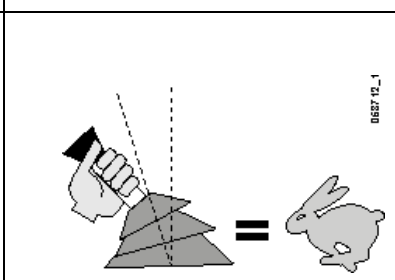
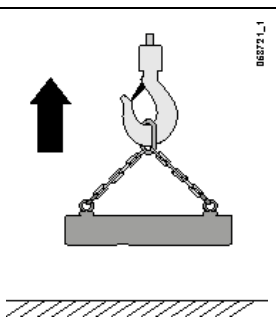
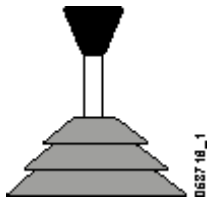
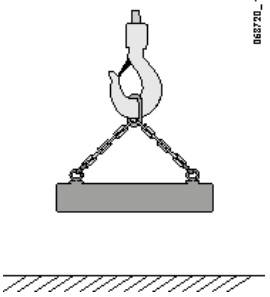
| | |
|---|---|
| **NOTICE** | Observe the load at all times while it is in motion to ensure that it does not collide with anything or fall from the lifting device. |

## Lifting

| | |
|---|---|
| **WARNING** | **Never touch the ropes, chains or slings during lifting. There is a risk of catching or trapping your hands in the hook block or hoist. Catching or trapping your hands in the hook block or hoist could cause serious injury or death.** |



| | | | |
|---|---|---|---|
| **1** | Ensure that everything is ready for lifting. |  |  |
| **2** | If the crane has a horn, push the horn pushbutton to warn people nearby that a load is about to be moved. |  |   |

| | | | |
|---|---|---|---|
| **3** | Gently push the UP control to slowly take up the slack from the chains or sling before lifting the load from the ground. |  |  |
| **4** | Continue to push the UP control until the load is just clear of the ground. |  |  |
| **5** | Push the UP control to lift the load at high speed. |  |  |
| **6** | Release the UP control gently when the load is at the desired height.<br>Do not raise the load higher than is needed to avoid colliding with objects. |  |  |

| | |
|---|---|
| **NOTICE** | Do not raise the load higher than necessary to avoid colliding with objects on the ground during movements. |

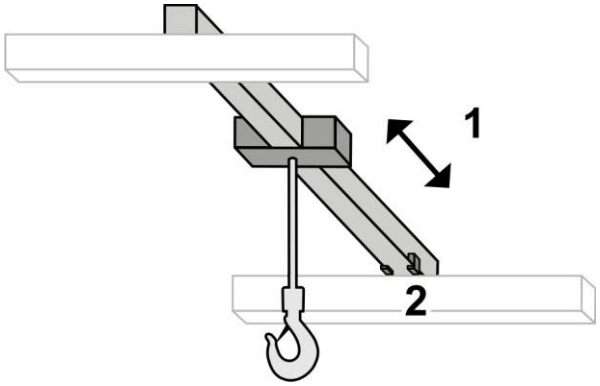
## Lowering

| | |
|---|---|
| **NOTICE** | Do not allow the hook or other lifting device to strike the load on the ground. The crane ropes could dislocate from the pulley grooves if they go slack. |



## 7.5.1 Traveling movements

This chapter describes the use of the controls so that you can drive the product properly and avoid hazards.



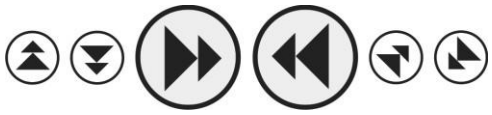

| Movements / items | Description |
|---|---|
| 1. **Trolley** movements | Horizontal movements of the **trolley** |
| 2. End stops | Limit **trolley** travel |

General information about traveling movements
Slow speeds should be used only for short periods, for example during precise positioning. Most movements, especially over longer distances, should be performed at higher speeds to improve ventilation of the motors.
End stops are fitted to the **runway** to limit travel of the **trolley**. Buffers are fitted to absorb the impact if the **trolley** runs into the buffer stops. Buffers are also fitted to prevent collisions between multiple trolleys.
End stops and buffers are intended for emergency use only. Do not use buffers and end stops as an operational means to stop travel during normal operations.

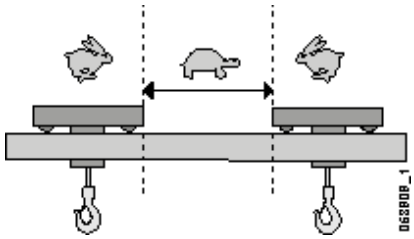
| | |
|---|---|
| **NOTICE** | Do not use end stops and buffers during normal operations. |

| | |
|---|---|
| **NOTICE** | Never allow the trolley to collide with the buffers or other trolleys. |

### Trolley movements

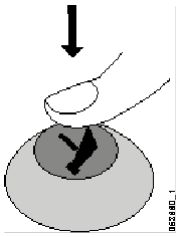
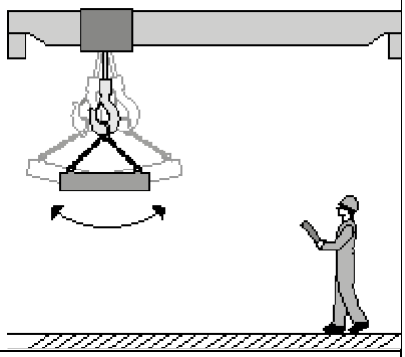
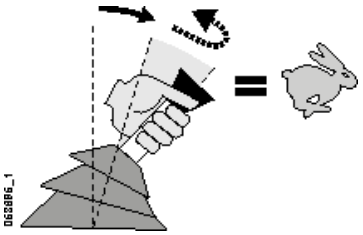
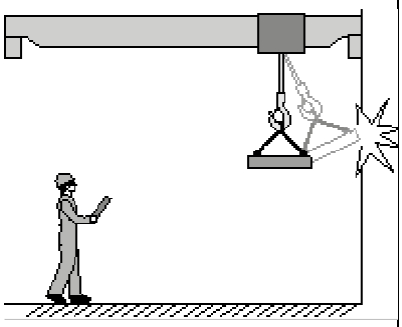
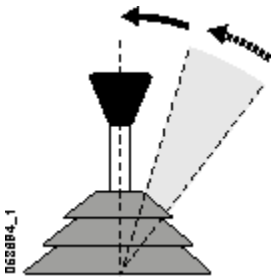
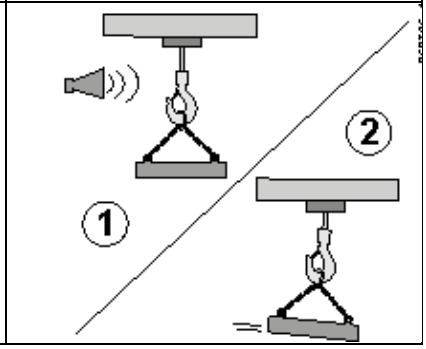


The product is fitted with the following devices which work in conjunction with trolley movements:

| | | |
|---|---|---|
| | **Trolley anti-collision device (Slow)**<br>The trolley anti-collision device prevents trolleys on the same bridge from colliding with each other. The device slows down both trolleys when they approach each other. |  |

**Electronic Potentiometer (EP) inverter control**

Inverter control stops the **trolley** smoothly by means of a preset deceleration ramp. The brake only activates AFTER the **trolley** has stopped moving. The operator must understand how the **trolley** behaves when decelerating to avoid overshooting the target or causing load swing.

| | | | |
|---|---|---|---|
| **1** | If the crane has a horn, push the horn pushbutton to warn people nearby that a load is about to be moved. |  |  |
| **2** | **Starting:**<br>Start the **trolley** motion by pushing the joystick to the half-way position.<br>Push the control fully to accelerate up to the desired speed and then release the control to the half-way position to maintain the speed. |  |  |
| **3** | **Stopping:**<br>Completely release the joystick to stop the **trolley** motion smoothly.<br>In an emergency, use the emergency stop button to stop the **trolley** immediately. |  |  |

| | |
|---|---|
| **NOTICE** | With inverter control, always allow time for the movement to decelerate to a smooth stop after releasing the direction control. |

## 7.6 Load Control

The operator must use the correct techniques to properly control the load at all times to prevent uncontrolled movements such as load swing or rotation.
If the load has a tendency to rotate or swing, a third person can guide the load with a tag line, provided that it is safe to do so.

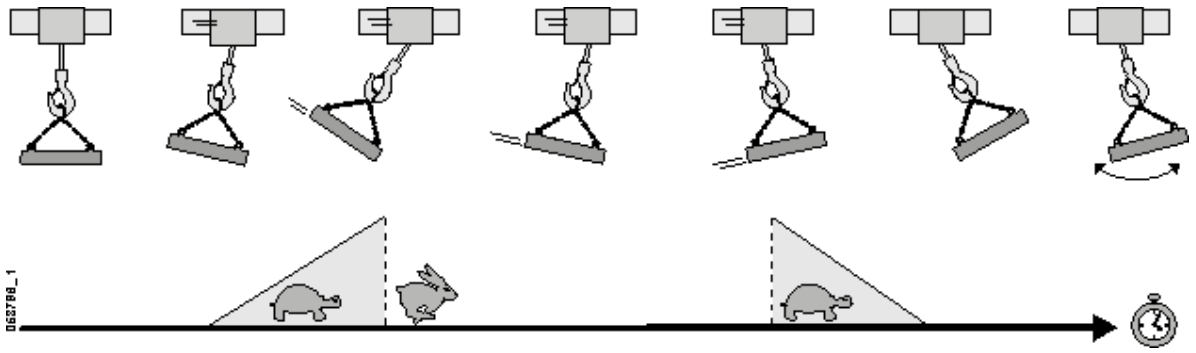
### Guiding or steadying loads by hand

| | |
|---|---|
| **WARNING** | **Never try to stop load swing with your hands. A swinging load moves with considerable force. Your hands or body could be seriously injured between the load and an obstacle or wall.** |

| | |
|---|---|
| **WARNING** | **Guiding or steadying suspended loads directly with your hands is prohibited. Use a tag line to guide the load or a more suitable lifting device. Your hands or body could be seriously injured between the load and an obstacle or wall.** |

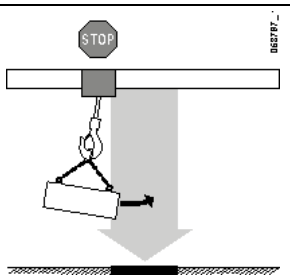
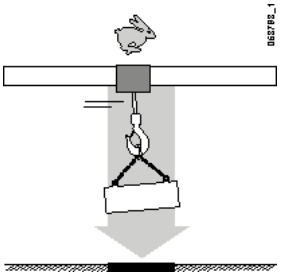
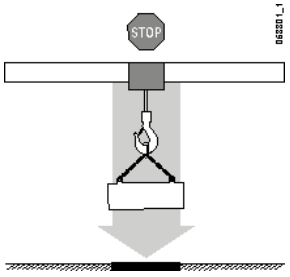
### Load swing

Load swing is caused by sudden speed or direction changes in the **trolley** or **bridge** movements. When starting up or accelerating, the load lags behind the **bridge** or **trolley**. When stopping or decelerating, the load tends to swing ahead, pulling on the product. If the product moves at high speed and then decelerates quickly, violent swinging may result. The load will swing further on a long rope than on a short one.



Preventing load swing
Load swing can be prevented or minimized by:
Accelerating and decelerating as gently as possible
Moving the product at a speed appropriate for the load (higher speeds increase the likelihood of swinging)
Transporting the load close to the **hoisting machinery** with short ropes
Coming to a complete stop before changing direction

The operator can prevent swinging by taking advantage of the leading pull of the load when bringing it to a stop:

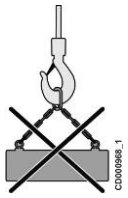
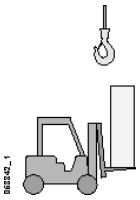
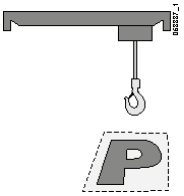
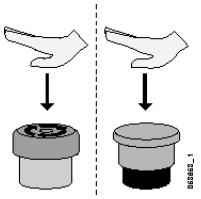
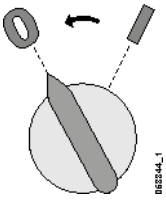
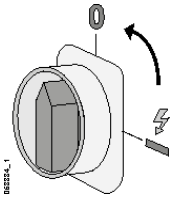
| | | |
|---|---|---|
| 1 | **Anticipate the swing and stop the product:**<br><br>Anticipate the swing of the load and stop the travelling movements just before the final setting point of the load. |  |
| 2 | **Accelerate to catch up with the load:**<br><br>At the instant the load is directly over the setting point, accelerate the travelling movements so that it catches up with the position of the load. |  |
| 3 | **Stop over the setting point:**<br><br>The load and travelling movements can both be stopped simultaneously over the setting point. |  |

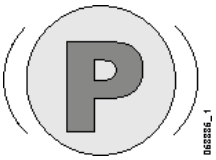
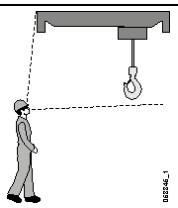
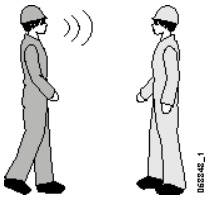


**Note:** You may need to repeat the above actions several times to completely

## 7.7 Safety procedure after using the product

The following checks must be done **after every working shift** to ensure that the product is left in a safe condition.

| | | | | | |
|---|---|---|---|---|---|
| 1 | Ensure that there is no load on the lifting device. |  | 2 | Park the hook or other lifting device where it will not present a hazard to people or traffic, but do not park at the upper stop limit. Above head height is recommended. |  |
| 3 | If applicable, park the product in an approved parking area. |  | 4 | Engage the emergency stop button. |  |
| 5 | Turn off all controls on the **controller**. |  | 6 | Turn off all power to the product with the **main isolation switch**. |  |

| | | | | | |
|---|---|---|---|---|---|
| **7** | If applicable, close mechanical brakes (rail clamps, storm locks etc.). |  | **8** | Visually check the product. |  |
| **9** | Report all observed defects and abnormalities in equipment or operation to the foreman and to the next operator. |  | | | |

| | |
|---|---|
| **WARNING** | **Always remove the product from service immediately if it is in a dangerous condition. Operating a product that is in dangerous condition could cause death or serious injury.** |

## 7.8 Hand Signals and Other Methods of Communication

When one person is operating the product and another is giving hoisting instructions, communication must be clear. Both people must agree on and understand the language they use to describe hoisting actions.

If electronic voice communication is used, such as telephone or radio, a dedicated channel must be used so that any commands from other personnel in the area will not confuse the operator.

**ANSI** standard hand signals can be used for communication (see Appendix – ANSI standard hand signals). Other standards for hand signals exist. The operator must be trained in the use of appropriate hand signals. A copy of the hand signals should be displayed at the operator's station and anywhere else where it could be useful.

Special operations may require additional hand signals. Special signals must be agreed upon and understood before hoisting. It should not be possible to confuse special signs with the standard signs.

The operator should only respond to hand signals from the person giving hoisting instructions, except to obey a stop signal, regardless of who gives it. The operator takes overall responsibility for movement and should only follow movement instructions when he or she judges it safe to do so.

# 8 MAINTENANCE

## 8.1 Why You Must Care About Maintenance

It is the **product owner's responsibility** to organize proper regular inspections maintenance to ensure long- term safety, reliability, durability, operability and warranty for the product. Keep this manual in a safe, accessible location during the whole lifetime of the product.

The owner must keep a record (log book) of all maintenance activities and usage relating to the product.

Different maintenance actions must be carried out at different intervals and by different persons, all of whom must be qualified and authorized to perform the checks which relate to them.

Daily checks and minor lubrication must be carried out by operators. These checks are very important to catch small faults before they become major faults.

Maintenance actions, excluding the daily actions performed by operators, must be done by service personnel who are authorized by the manufacturer or manufacturer's representative.

The owner shall ensure that replacement parts and materials meet the specifications defined by the product manufacturer.

| | |
|---|---|
| **WARNING** | **Do not modify the product without the manufacturer's permission. Any modifications to the product structures or performance values must only be made after they have been approved by the product's manufacturer.** |
| **NOTICE** | Modifying the product without the manufacturer or manufacturer's representative approval can invalidate the guarantee. Furthermore, the manufacturer does not accept responsibility for accidents which happen as a consequence of unauthorized modifications. |
| **NOTICE** | Ensure that the equipment used for maintenance work is suitable for the lifting height. Two persons are required for the maintenance work. |
| **WARNING** | **Failure to regularly and properly maintain the product can result in death, injury or damage.** |
| **WARNING** | **Do not allow the product to be used if it is not in proper condition. Contact a service agent authorized by the manufacturer or manufacturer's representative immediately in case of doubts! The usage of a defective product can result in serious damage, injury or death.** |
| **CAUTION** | **Only use genuine spare parts, materials and lubricants approved by the product's manufacturer or manufacturer's representative. Consult your spare parts catalog for further information.** |
| | **Before maintenance the owner must see the instructions in chapter *"Safety first"*** |

## 8.2 Service Personnel

Only authorized service personnel or an experienced service technician authorized by the manufacturer or manufacturer's representative may perform the detailed examinations necessary for scheduled maintenance. Such examinations must be performed in accordance with the inspection and maintenance plan provided by the product's manufacturer. The original manufacturer or manufacturer's representative has approved authorized service personnel to maintain its products.
The owner or operator of the product must perform the daily checks and, if required, daily lubrication. Service personnel authorized by the owner may also lubricate the product at the necessary intervals.



**Note:** Mechanical and electrical maintenance work requires special skills and tools to ensure safe and reliable operation of the product. Maintenance work shall be carried out only by authorized service personnel or an experienced service technician authorized by the product's manufacturer or manufacturer's representative.

## 8.3 Log Book

The crane log book is supplied in the interest of accident prevention. It is an integral part of the equipment and shall be kept up-to-date and with equipment all the times. Do not remove or discard any parts of the log book for any reason. The log book records the complete maintenance history of the equipment and it must be transferred to the new owner when ownership of the equipment changes.



**Note:** The owner (who has the primary responsibility), operators and service personnel must ensure that the log book is kept up to date.

The log book consists of the following items:

- Product reference data: details of the product, its ownership and persons who are qualified to work with it.
- Faults noticed in daily inspections, together with corrective actions.
- Records of service inspections and lubrication.
- Records of repairs.
- Records of condition monitoring unit or hour counter.
- Calculations of safe working period and remaining lifetime.

According to the ISO 12482-1 standard, records of the crane usage must be kept, so that the usage can be compared to the supplier's design principles and design limits. Records shall also be kept for all maintenance, inspections and unusual occurrences (e.g. unexpected loads from operational error, extreme climatic conditions, etc.), breakdowns, repairs and modifications.
Where complete records aren't available, it shall be inspected in accordance with Annex A of ISO 9927-1 and any requirements as a result of that inspection shall be carried out before further use of the equipment.

## 8.4 Inspections

The operator/owner of a product shall carry out regular inspections to ensure the safe operation. The product's owner shall also keep record of the inspections and findings.
Periodic inspections must be carried out by authorized service personnel or experienced service technician authorized by the product's manufacturer or manufacturer's representative. Inspections must be carried out according to manufacturer's instructions.



**Note:** If the working environment or product usage changes, the inspection and maintenance intervals may need to be revised.



**Note:** Products used under harsh conditions may require shorter service intervals. Consult with the manufacturer or manufacturer's representative for a tailored service agreement.



**Note:** Periodic inspections SHALL be carried out in accordance with local regulations.

| | |
|---|---|
| **CAUTION** | **Any defects or abnormalities which are detected during the inspections must be investigated and corrected in accordance with the instructions relevant to component in question.** |

### 8.4.1 Daily Inspections

Daily inspection items are listed in chapter "Instructions for the operator". In most cases these checks will be performed by operators.

### 8.4.2 Periodic Inspections



**Note:** Periodic inspections are normally performed every twelve months but must be performed every time the product's Safe working period (SWP)% has reduced 10%.

Inspections every 12 months



**Note:** Any defects or abnormalities which are detected during the inspections must be investigated and corrected in accordance with the instructions relevant to the component in question.

**Hoist**

| Component | Objective | Method |
|---|---|---|
| General | Visually check the general condition and accumulation of dust or dirt. Clean off all dust and dirt.<br>Visually check that covers are not damaged. Check paint coating and rust.<br>Test by hand that all covers are fixed. | Visual/Test |
| Gearbox | Check the oil level. Check for loose or missing fittings. Check the gearbox temperature by hand. Check that the breather is clean. Listen while driving for abnormal sounds or vibrations. | Visual/Aural/Test |
| Motor coupling | Check the play through the hole on the coupling box. The coupling color shall be white. If the color is no longer clean white, the grease is most probably leaked out, and the coupling shall be opened for inspection. | Visual |
| Electric motor | Check that the connections are in a good condition. Check the encoder condition. Check for loose or missing fittings. Check the motor temperature by hand. Listen for abnormal sounds. | Visual/Aural/Test |
| Air gap measuring | Measure the brake disc air gap. | Test |
| Brake disc friction material | Measure the brake friction material's thickness. | Test |
| Rope drum hub | Check for loose or missing fittings. Look for possible cracks or deformations. | Visual/Test |
| Rope drum grooves | Measure an unworn section of the drum to determine the baseline to establish the acceptable wear measurements. | Test |
| Wire rope | Check the wire rope for broken threads and bending. | Visual |

**Trolley power supply**

| Component | Objective | Method |
|---|---|---|
| Cables | Check the condition of the cables. | Visual |
| Cable trolleys | Check the condition of the cable trolleys. | Visual/Test |
| Cable support rails | Check the fastenings, condition and cleanliness of the cable support rails. | Visual |
| Cable seals | Check the condition of the cable seals. | Visual/Measure |
| Wiring | Check the condition of the wiring and its connections. | Visual/Test |
| Delay relays | Check the operation of the delay relays. | Visual/Aural |

**Limiting devices**

| Component | Inspection and maintenance task |
|---|---|
| Trolley buffers | Check condition of trolley buffers and buffer end stops. Check condition of rail sweeps if any. |
| Trolley traveling limit switches | Check visually that traveling limit switches are operating in correct position. Check wiring. |

| | |
|---|---|
| Hoisting limit switches | Check visually the condition of hoisting limit switches. Test the operation of limit switch. |
| Ultimate hoisting limit switch (optional) | Check condition of ultimate hoisting limit switch. Check wiring.<br>Test the proper operation of ultimate hoisting limit switch. |
| Overload protection | Check condition and free movements of mechanical parts.<br>Conduct operation test of overload device according to local regulations if required. Clean and lubricate lever mechanism. |

**Electrics**

| Component | Objective | Method |
|---|---|---|
| Current collectors | Check the condition of the crane current collectors. | Visual |
| Overcurrent protectors | Check the adjustment of overcurrent protectors. | Visual/Test |
| Emergency stop | Check the operation and condition of the emergency stop button. Check that the emergency stop button is clean and not damaged. | Visual/Test |
| Main isolation switches | Check the operation and condition of the main isolation switches. | Visual/Test |
| Main switch for hoist | Check that the main switch is clean, clearly marked, and there are no visible damages.<br>Test manually that the main switch will switch off the hoist. | Visual/Test |
| Wiring | Check the condition of the wiring and its connections and the terminal connections.<br>Follow the power supply and visually check potential areas for damages. Check wiring for any signs of wear, crushing, breaks, or cuts.<br>Check visually that the cable bushings are tight. Check visually that the connectors are not damaged.<br>Test by hand that the cable bushings and connectors are tight.<br>Check the tightness of screws at terminal blocks and the connections of other components randomly. | Visual/Test |
| Limit switches | Check the operation of the limit switches. | Visual/Test |
| Cubicle | Check cleanliness, security, and fastenings of the cubicle.<br>Check air conditioning and filters if any.<br>Check the security of the fastenings in the electrical cubicle. | Visual/Test |
| Contactors | Check the operation and condition of the contactors.<br>Check visually that the contactors are clean and there are no visible damages. Check the hoisting operation counters on condition monitoring unit. | Visual/Aural/Test |
| Fuses | Check the condition of the fuses.<br>Check visually that the fuse holder and fuses are clean and there are no visible damages.<br>Check correct amperage rating. | Visual |
| Braking resistors | Check that the braking resistors are clean and that the wires are securely fastened. | Visual |
| Stickers | Check that the stickers are readable. | Visual |
| Load display | Check the operation and condition of the load display. | Visual/Test |
| Braking resistors (with some frequency converter model) | Clean all dust or dirt from braking resistors. | Visual/Test |

| | | |
|---|---|---|
| Hoisting inverter | Check that the wires are securely fastened. Check the fault code records.<br>Check the operation and cleanliness of the cooling fan. | Visual/Test |
| Traveling inverter | Check that the wires are securely fastened. Check the fault code records.<br>Check the operation and cleanliness of the cooling fan. | Visual/Test |
| Condition monitoring unit | Check the operation mode. Check the fault code records. Lift a known load and verify that the unit reads the load within 5% of the load. | Visual/Test |

**Motors and gears**

| Component | Inspection and maintenance task |
|---|---|
| Manual brake release for hoisting motor (optional) | Check that manual brake release tools are available. Check that operating instructions are available. |
| Manual crank for hoisting motor (optional) | Check that manual crank and brake release tools are available. Check that operating instructions are available. |
| Second brake (optional) | **Check that there is no visible damage.**<br>Check that the outside surface of the brake is clean.<br>Test that second brake operates after the main brake. Lifting and lowering will brake smoothly and braking time and distance is acceptable.<br>If needed inspect the brake disk and clean the brake. |
| Drum brake (optional) | Check cleanliness of drum brake. Check visually the brake condition:<br>Brake bands are on correct position.<br>Cam spring is good.<br>Actuator mechanism is clean and moves freely.<br>Test that the cam operates correctly when lifting and lowering.<br>Test that electric switch will stop the motions.<br>Lubricate the actuator and cam mechanism if needed. |
| Traveling gear | Check visually the gearbox fastenings.<br>Check the gearbox visually for leakage.<br>Check visually torque support mounting and rubber bushing if any.<br>Test the running sound and vibrations with load.<br>Check that breather-plug breaths freely.<br>Check temperature of travelling gearbox by hand.<br>Check oil level if oil filled traveling gear.<br>Lubricate the open transmission if any. |
| Hoisting gears | Check visually the gearbox fastenings.<br>Check the gearbox visually for leakage.<br>Test the running sound and vibrations with load.<br>Check that breather-plug breaths freely.<br>Check temperature of hoisting gearbox by hand.<br>Check oil level if oil filled hoisting gear. |
| Motor/Gear coupling | Investigate the condition of coupling between motor and gear. Lubricate and replace.<br><br>Interval is SWP% reduction or calendar months, whichever limit is reached first.<br><br>**The coupling must be replaced if there is any visible damage or rust inside the coupling or if the O-rings have any visible damage or signs of aging.**<br>**Lubricate the coupling and motor splines carefully.** |

**Mechanical component**

| Component | Inspection and maintenance task |
|---|---|
| Rope drum | Check condition and cleanliness of rope drum. Check the grooves of the drum.<br>Check visually that connection rods are straight and fixing screws are tight. Check condition of axial locking part if any.<br>Check proper rotation of drum and condition of bearings. Pay attention to running sound of rope drum bearings and check that the rope drum does not touch with machinery end plates or other parts.<br>Check the operation of axial locking part if any. Lubricate the drum surface.<br>Lubricate drum bearings if not life time lubricated. Inspect visually and lubricate the gear rim on drum if any. |
| Rope guide | Check condition of the rope guide.<br>Check for loose or missing fittings.<br>Check pressure bearing condition if any.<br>Test proper operation of the rope guide.<br>Lubricate the rope guide.<br>Clean the rope guide guiding rod. |
| Rope reeving | Lift the hook up and lower down. Pay attention to:<br>Does the hook block try to rotate.<br>Can the reeving balancing tilt freely (two rope systems, if any).<br>Does the rope move smoothly over all sheaves and trough the rope guide.<br>Is the rope tight on drum grooves.<br>Remove rotation and reassemble the end fixing if needed. |
| Rope clamp | Check condition and correct fastening of rope clamp. Check that the rope clamp bolts are tight.<br>Ensure that there are the friction turns when the hook is at the lowest position. Make sure the rope end protrudes from the last clamp a specified distance. |
| Rope anchorage | Check condition and correct position of rope anchorage.<br>Ensure that the rope is assembled inside the rope anchorage correctly. Check that the rope clamp nuts are tight.<br>Ensure that the rope has not slipped in the rope anchorage by comparing to nominal measures. Make sure the rope end protrudes from the rope anchorage as specified.<br>Check the condition of the wire rope near the rope anchorage. Check the anchorage shaft locking.<br>Lubricate the pivot bearing surfaces of rope anchorage if needed. |
| Wire rope | Check condition of the rope. Inspect the rope(s).<br>Lubricate the rope. |
| Hook block | Check operation and condition of hook block. Check visually that:<br>Stickers exist and are readable.<br>Covers are not damaged and do not touch to sheaves or rope.<br>Hook hangs perpendicularly. Lift empty hook and test that:<br>Hook does not rotate.<br>Empty hook do not tilt.<br>Test that rope runs smoothly on sheaves with and without load. |
| Cross bar | Check condition of cross bar hinge if any by tilting the hook forging.<br>Check condition of hook forging pressure bearing by rotating the hook forging. Insert grease to cross bar hinge grease nipple if any.<br>Open the cross bar and lubricate the pressure bearing if needed. |
| Hook safety latch | Test by hand that safety latch is not damaged and spring keeps it closed. |

| | |
|---|---|
| **WARNING** | **STRONG MAGNETIC FIELD!**<br>**Magnets can impact the functioning of pacemakers, implanted heart defibrillators, and hearing aids.**<br>**If you wear these devices, follow precautions associated to magnetic forces.** |

| | |
|---|---|
| Hook latch trigger (magnet operated) | Test the operation of the latch trigger. Adjust the trigger play (movement) with the adjustment screw if necessary.<br>**Clean the magnet when dirty.** |
| Hook forging | Check condition of hook forging.<br>Measure the hook forging opening if needed. |
| Rope sheaves | **Check condition of sheaves. Inspect the measures if wear.**<br>Check condition of rope sheave support structure.<br>Check that the sheave support shafts are correctly in their slots and correctly locked.<br>Replace the support shaft by latest construction/parts if not done yet (some Low Headroom Trolley models). Test by driving the smooth rotation of the rope sheaves. |
| Trolley wheels | **Check condition and cleanliness of trolley wheels.**<br>Visually check the wear of trolley wheel surfaces and flanges if any. Check adjustment of rail width or rail gauge –measure.<br>Test trolley wheel operation. Pay attention to running sound of bearings. If needed lift the trolley and test by hand the free and smooth rotation of trolley wheels.<br>Check that wheels are correctly aligned and check possible wear caused by misalignment. Lubricate the bearings if needed and possible. |
| Load carrying structure | Check condition of bolted joints and load carrying structures.<br>Visually check bolted and welded connections of securing and back up components like mounting of derailment catch if any. |

**Controls**

| Component | Inspection and maintenance task |
|---|---|
| Pendant | Check condition and functionality of push buttons and switches. Check all markings and signs that they are readable.<br>Drive all movements. Test all functions. |
| Radio | Check condition and functionality of push buttons and switches. Check all markings and signs that they are readable.<br>Drive all movements. Test all functions. |

**Options**



**Note:** The product may have options which also require inspection. Make sure that all components are inspected.

## 8.5 General Lubrication Instructions

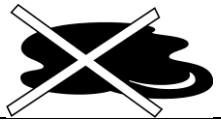
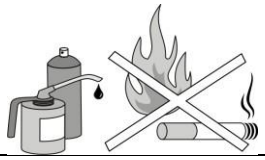
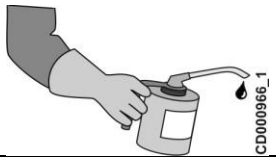
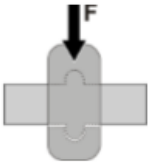


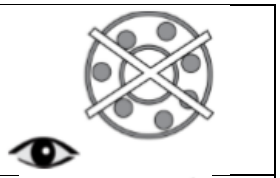
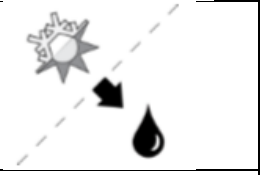
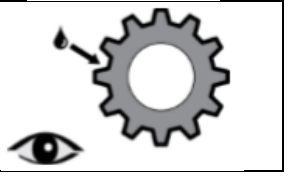
**Note:** Most of the bearings in the product have lifetime lubrication. There is no need to add lubricant to the life time lubricated bearings under normal operating conditions.



**Note:** If transmission oil has to be topped up, make sure that the lubricant being added is compatible. If transmission oil has to be replaced, flush out the gearbox before refilling.

The following table provides advice on the lubrication procedures which should be followed.

| | | |
|---|---|---|
| **1** | Usage of a low grade or incompatible lubricant can damage the gearing or bearings. Use only lubricants recommended by the product's manufacturer. See the lubricant tables for more information.<br><br>Use only fresh oil/grease. Different kinds of lubricants shall not be mixed.<br><br>Information about each chemical's safe handling , risks and handling as waste are described in the Safety Data Sheet that is available from manufacturer of the lubricant.<br><br>**Note:** equipment may have synthetic lubricant as a factory installed lubricant. Please refer to order confirmation. |  |
| **2** | Handle lubricants carefully. Prevent leakages to waters, sewers, cellars and other closed places. |  |
| **3** | Keep lubricants away from heat and open fires. Do not smoke when handling lubricants. |  |
| **4** | Avoid contact with skin. Protection gloves and safety goggles shall be worn when handling lubricants. Hands shall be washed thoroughly after lubrication. |  |
| **5** | Keep lubricants away from food and drink. Do not inhale any fumes or swallow lubricants. |  |
| **6** | Used lubricant shall be handled as hazardous waste following local legal requirements.<br><br>Store used lubricant in containers indicated for the purpose and dispose by a licensed company. |  |
| **7** | Keep grease nipples clean. |  |
| **8** | All slide bearings must be depressurised for the grease to be able to penetrate. |  |

| | | |
|---|---|---|
| **9** | While lubricating, check the functioning of the bearings and observe whether there is any bearing slackness. |  |
| **10** | The specified lubrication periods apply in favourable conditions and normal use. More frequent lubrication is recommended in more demanding conditions and in heavy use, particularly of the slide bearings. |  |
| **11** | Verify that the gear teeth of the open gear transmission are entirely lubricated. |  |

**Note:** Do not use excessive lubricant. Excessive grease may cause bearing to overheat and reduces the lifetime of the bearings.

## 8.6 Approaching Theoretical Calculated Lifetime

In order to ensure safe operation of cranes, the proper working and operational condition shall be maintained according to standard ISO 9927.
This requirement covers also special assessments to be carried out by an expert engineer at regular intervals to check the remaining Safe Working Period (SWP) of the hoist as stated in standard ISO 12482-1.

### 8.6.1 General Overhaul

In the GO service, the product is assigned with a new, runtime-based SWP, provided that it is safe to continue the operation. The runtime-based SWP means the lifetime of the interchangeable rotating components of the hoist like hoisting gear, hoisting motor, and rope sheaves. Note that in case of hoists with a smaller drum size, it is often more cost-efficient to replace the hoist with a new one.

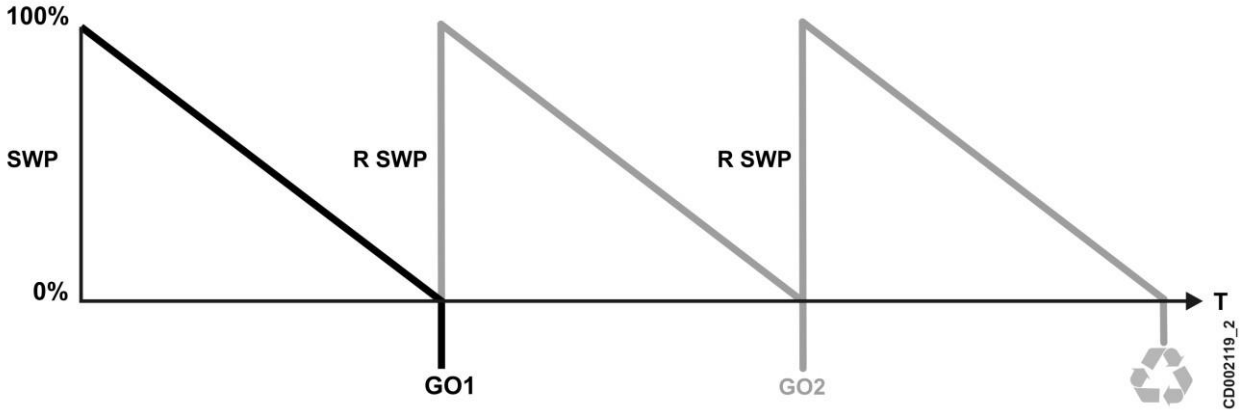
| | |
|---|---|
| **WARNING** | **When the Safe Working Period (SWP) of the hoist has decreased to zero or is counting in the negative, the hoist may only be used after a GO service has been conducted, or the hoist must be replaced with a new one. Any usage of a defective hoist can result in serious damage, injury, or death.** |

| | |
|---|---|
| **CAUTION** | **When performing General Overhaul, the construction of the hoist may not be changed or the supporting structures repaired without permission from the manufacturer. If there are any deformations, cracks or corrosion in the supporting structures of the hoist, the parts have to be replaced or repaired according to the instructions given by the manufacturer.** |

Only authorized service personnel or an experienced service man that is authorized by the manufacturer or manufacturer representative may conduct a General Overhaul service.

The same hoisting machinery can undergo no more than two GOs before it must be replaced

completely:

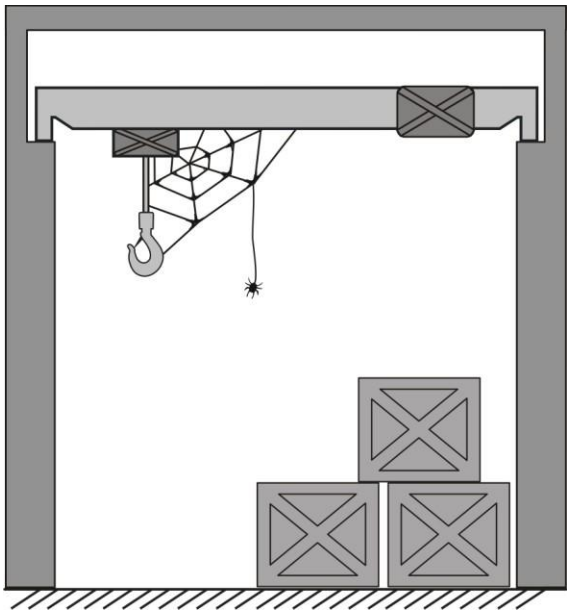



*SWP = Safe Working Period*
*RSWP = Runtime-based Safe Working Period GO1 = First General Overhaul*
*GO2 = Second General Overhaul T = Time*

## 8.7 Returning the Product to Use after a Long Period Out of Service



**Note:** These actions should also be carried out if the product has been exposed to extreme



For storing conditions refer to the Appendix “Transportation and storing the product”.
When taking the product into use after a long period, checks must be done according to chapter “Checks to be done before every working shift”.
Before returning the product to use, carry out the relevant checks listed in the “General safety”, “Safety during installation and disassembly” and “Safety during maintenance”.

| | |
|---|---|
| **NOTICE** | Before using the equipment, proper commissioning shall be carried out. Commissioning procedure is instructed in “Installation and Commissioning Instructions for Hoist”. |

# 9 DISMANTLING

## 9.1 Dismantling the Product

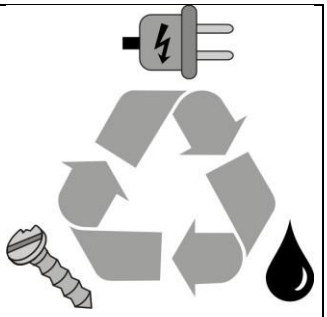
The product will need to be dismantled at the end of its life or if it must be moved to a new location. Strict safety precautions shall be followed when dismantling the product. For example, when working at heights, fall protection procedures must be followed. Only experienced service personnel are permitted to dismantle the product.
The owner shall nominate a person to be responsible for the dismantling process. This person shall give instructions and monitor the process.
All controls must be placed in the OFF position, safety switches must be opened and the main isolator switch must be turned off. The product must be electrically isolated before dismantling commences.
Make sure that all personnel involved are aware that the product will be dismantled before dismantling commences.
The owner must prevent unauthorized persons and bystanders from walking on or below the work site.
Ensure that the secured area is spacious enough to prevent injuries which could occur as a result of falling components or tools.
Only use safe tools and machinery for dismantling.
Make sure that removed fastenings and components will not fall.
Pay attention to the environmental conditions. For example, do not disassemble the product if the prevailing weather could compromise safety.
The disassembly sequence is completed in the reverse order to the assembly sequence. Refer to installation/assembly instructions for correct sequence.
After the product has been dismantled, the owner or person responsible for the dismantling can return the working area back to normal use.

## 9.2 Disposal of Waste Material

Waste material from installation, maintenance or dismantling shall be handled and disposed of according to local regulations. From the sustainability point of view, the preferred waste handling methods are reuse, recycle as material, recycle to energy, and as a final resort, safe disposal.
As waste regulations and types of recovery and disposal methods vary so much regionally, no general detailed guidance can be given. The chart below gives example of manufacturer's proposals for adequate waste handling methods.

| NOTICE | Use always licensed recycling companies. |
|---|---|

| | | |
|---|---|---|
| 1 | **Metals** should be recycled. | |
| 2 | **Electronics and electromechanical components** should be collected separately and recycled. Some electrical parts may be treated as hazardous waste, e.g. standard fluorescent lamps contain mercury. | |
| 3 | **Batteries** and other energy storage components may contain hazardous substances. These items should be collected separately and recycled according to local regulations. | |
| 4 | **Plastics** should be either recycled as material or used for energy recovery or landfilled. PVC plastic should be recycled according to local regulations. | |

| | | |
|---|---|---|
| **5** | **Chemicals**, like oil, grease and other liquids shall never be spilled onto the ground, soil or sewage. Waste oil and grease shall be stored in containers indicated for the purpose. More detailed information of chemical handling as waste can be found in the chemical's Safety Data Sheet that is available from manufacturer of the chemical. |  |
| **6** | **Packing materials**, like plastics, wood and cardboard, should be reused or recycled as material or to energy. | |

# APPENDIX: TIGHTENING TORQUES

The following tightening torques shall be applied on bolts in cases, where tightening of a bolt is not specified in any way in the relevant drawing.
Tightening must be done using a tool or method, where the applied torque is measured and indicated.
See below screw joints, recommended tightening torques. Measurements are given in Nm. A friction coefficient $\mu = 0{,}14$ is assumed in the calculations of the preceding tightening torques.

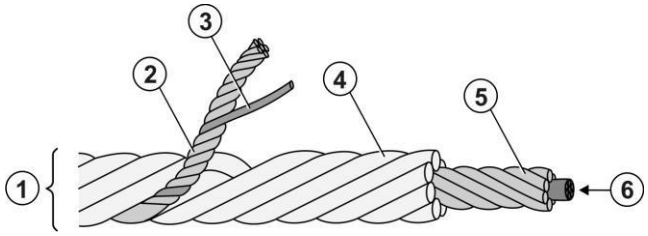
| | **Tightening torque (Nm)** | | |
|---|---|---|---|
| **Size** | **Strength class 8.8** | **Strength class 10.9** | **Strength 12.9** |
| M2 | Hand tight (0.39) | Hand tight (0.55) | Hand tight (0.66) |
| M3 | Hand tight (1.41) | Hand tight (1.98) | Hand tight (2.37) |
| M4 | Hand tight (3.3) | Hand tight (4.8) | Hand tight (5.6) |
| M5 | Hand tight (6.5) | Hand tight (9.5) | Hand tight (11.2) |
| M6 | Hand tight (11.3) | Hand tight (16.5) | Hand tight (19.3) |
| M8 | 25 | 35 | 42 |
| M10 | 49 | 69 | 83 |
| M12 | 86 | 122 | 145 |
| M14 | 136 | 190 | 230 |
| M16 | 210 | 300 | 360 |
| M18 | 290 | 410 | 495 |
| M20 | 410 | 590 | 710 |
| M22 | 560 | 790 | 950 |
| M24 | 710 | 1000 | 1200 |
| M27 | 1040 | 1460 | 1750 |
| M30 | 1410 | 2000 | 2400 |
| M33 | 1910 | 2700 | 3250 |
| M36 | 2460 | 3500 | 4200 |



**Note:** It is recommended that self-locking nuts (Nyloc nut) are always replaced when removed. Self locking nuts can be reused no more than 5 times.

# APPENDIX: CRITERIA FOR INSPECTING AND DISCARDING WIRE ROPES

Structure of wire ropes




| Pos. | Part |
|---|---|
| **1** | Rope |
| **2** | Strand |
| **3** | Wire |
| **4** | Outer strand layer |
| **5** | Inner strand layer |
| **6** | Core |

The lay of strands (wire rope) can be twisted either to the left or to the right. To determine whether the lay is left or right handed, look along the rope and see whether the wires appear to turn anti-clockwise (left handed) or clockwise (right handed) as they get further away from you.



**Left hand lay of strands in the rope**



**Right hand lay of strands in the rope**

Discard Criteria



**Note:** Regular rope inspection and maintenance shall be carried out according to the guideline instructions provided by the manufacturer and according to international standard ISO 4309:2009.



**Note:** Mechanical and electrical maintenance work requires special skills and tools to ensure safe and reliable operation of the product. Maintenance work shall be carried out only by authorized service personnel or an experienced service technician authorized by the product's manufacturer or manufacturer's representative.

**Note:** The internal examination of wire rope shall not be done as part of regular maintenance, unless the person is trained for that examination (ISO4309 Annex D).

| | |
|---|---|
| **WARNING** | **The rope shall be changed before the limits are reached. Change the rope if there is a risk that the limits will be reached before the next examination.** |

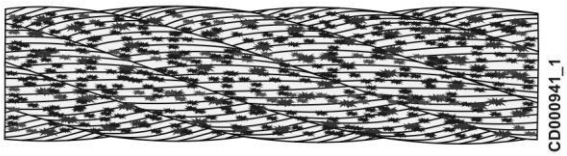
| | |
|---|---|
| **WARNING** | **Replaced wire rope must be the same size, type, construction, length as original to prevent failures. Different kind of rope may cause the load to fall, which could result in serious damage, injury or death.** |

| | |
|---|---|
| **CAUTION** | **Protective gloves shall be used to avoid getting wire splinters or cuts to the hands.** |

**Note:** If rope needs to be changed, the owner should ensure that the old rope is disposed according to local regulations. Refer to chapter Disposal of waste material

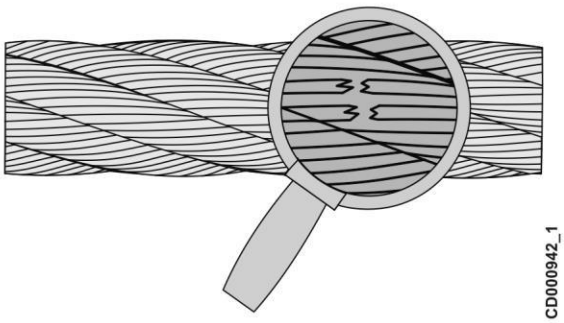
Load carrying ropes shall be inspected along their full length, but particular attention shall be given to certain rope parts. Each wire rope shall be examined in the areas which are most regularly flexed over the rope sheaves during normal operation, and at the rope end near to the wedge housing.
Carefully clean the examination areas before inspection.

External corrosion




| | |
|---|---|
| **CAUTION** | **Severe corrosion may decrease elasticity of the rope. Wire ropes shall be discarded immediately if corrosion is causing wire slackness.** |

**Broken wires**

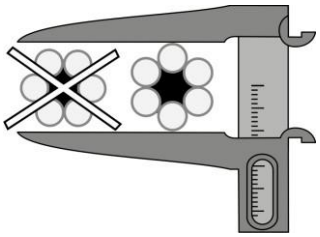



| | |
|---|---|
| **CAUTION** | **Wire ropes shall be discarded immediately if more than one strand is broken. To optimize the lifetime of the rope, refer to discard criteria in standard ISO 4309.** |

**Local reduction of rope diameter**

A reduction in the rope diameter in any part of the rope is an indication of internal or external wear or damage.

To accurately measure the diameter at any point of the rope, rotate the vernier caliper around the rope to record the maximum dimension.

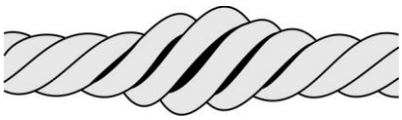


| | |
|---|---|
| **CAUTION** | **Standard or heavy duty ropes shall be discarded when the actual diameter at any point of the rope is 7% less than the nominal diameter. Rotation resistant ropes shall be discarded when the actual diameter at any point of the rope is 3% less than the nominal diameter.** |

Local increase of rope diameter
An increase in rope diameter in any part of the rope is an indication of deformation inside the rope.

| | |
|---|---|
| **CAUTION** | **Ropes shall be discarded when the actual diameter at any point of the rope is 5% more than the nominal diameter.** |

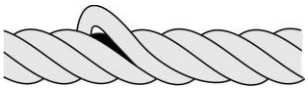
Basket (birdcage) deformation



Basket (birdcage) deformation occurs when there is a difference in length between the rope core and outer strands.

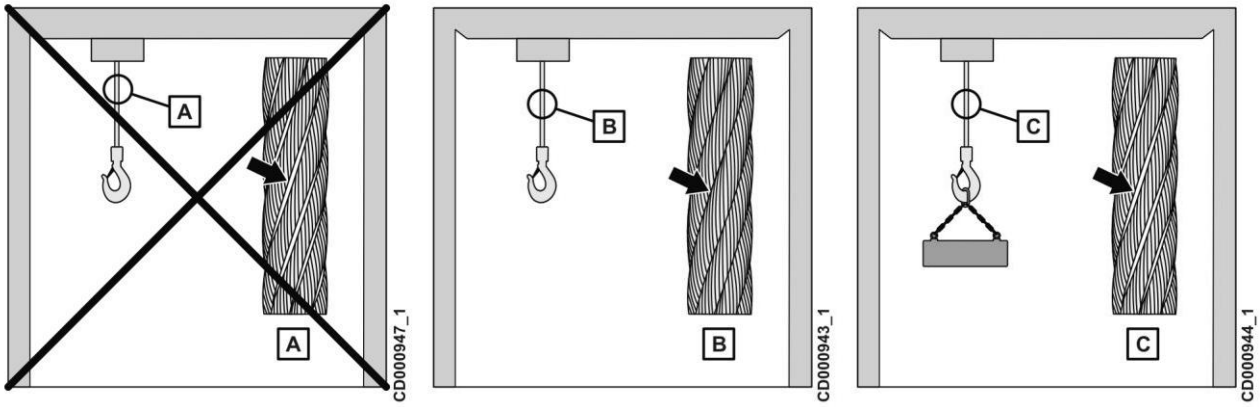
| | |
|---|---|
| **CAUTION** | **Ropes with basket deformation shall be discarded immediately.** |

Protrusion of rope parts



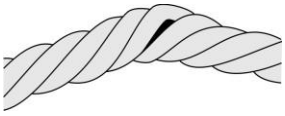
| | |
|---|---|
| **CAUTION** | **Ropes in which there is a protrusion of core, strand, or group of wires shall be discarded immediately.** |

**Loose outer strands**
The outer strands of the rope shall be tight when there is no load (drawing B) on the rope. When standard or heavy duty ropes are under load, there can be small visible gaps between the outer strands (C). If these gaps do not close when the load is released, the rope shall be discarded (drawing A).




| | |
|---|---|
| **CAUTION** | **If there are visible gaps when there is no load on the rope, the rope shall be discarded immediately.** |

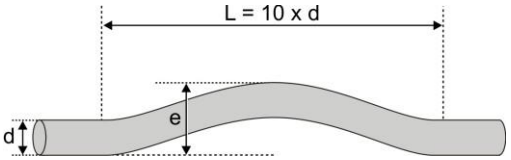
Kinks



If there is a loop in the rope, the rope must be able to turn about its axis as it is tightened, otherwise a kink will form.

| | |
|---|---|
| **CAUTION** | **Kinked ropes shall be discarded immediately.** |

Bends




Bends and other angular deformations in ropes are normally caused by external influences.

| | |
|---|---|
| **CAUTION** | **For mild bends, carefully check for broken wires in the area of the bend. Discard the rope according to chapter “Broken Wires”.** |

Mild bends can often be removed by carefully bending the rope by hand to straighten out the bend.

| | |
|---|---|
| **CAUTION** | **Discard the rope if the maximum deviation “e”, is more than twice the rope diameter (2 x d) over a section of rope whose length is equal to ten times the rope diameter.** |

# APPENDIX: TROUBLESHOOTING

The table below lists some of the faults and malfunctions that may occur in the hoist, their causes and the corrective actions needed to eliminate them.

| | |
|---|---|
| **CAUTION** | **If you are unable to identify and eliminate the fault using this table, contact a service agent authorized by the manufacturer.** |

| | |
|---|---|
| **WARNING** | **Do not allow the product to be used if it is not in proper condition. Contact a service agent authorized by the manufacturer or manufacturer's representative immediately in case of doubts! The usage of a defective product can result in serious damage, injury or death.** |

| Fault | Probable cause | Corrective action |
|---|---|---|
| The hoist is not operative. | Main supply power is not connected. | Switch the main power supply on. Release the Emergency Stop button. Press the Start button. Refer to section "Instructions for the operator". |
| | A fuse has blown. | Replace the fuses. |
| | The hoisting motor has overheated and the temperature sensor is preventing operation. | Wait for the motor to cool. Avoid unnecessary and repetitive short starts. |
| | A motion has reached its limit. | Drive away from the limit. |
| | One phase is dead (no voltage). | Repair the power supply. Contact service personnel. |
| The hoist is operative but does not hoist the load. | The hook is holding an overload. | Check that the load on the hook does not exceed the maximum permitted load. |
| The load slips downwards. | The hoisting brake is worn. | Contact service personnel authorized by the manufacturer. |
| Hoist motions are in the wrong direction. | The phases of the power supply are connected wrongly. | Contact service personnel authorized by the manufacturer. |
| Travel motion is not operative or makes a loud noise. | There are obstructions on the track. | Clean the track. |
| | Travel control is malfunctioning. | Contact service personnel authorized by the manufacturer. |

# APPENDIX: TRANSPORTING AND STORING THE PRODUCT

Transportation Instructions

- Products shall be loaded and transported with caution and using appropriate methods, making proper preparations and taking appropriate caution.
- Loading or transporting products is prohibited if your alertness or working ability is impaired, for example by medication, illness or injury.
- The load must be securely fastened during transportation.
- During loading and transportation, the product package shall be orientated in the same way as when it was received from the manufacturer. Inverting the product could cause lubricants to leak.

Storage Instructions

The product should be stored at room temperature.
The product shall be protected from dust and humidity.
The product shall be stored the same way up as it would be during normal operation.
The product shall be protected from adverse weather conditions, if stored outdoors.

| | |
|---|---|
| **NOTICE** | Defects or faults which are due to improper transportation or storage are not covered by the product's warranty. |

| | |
|---|---|
| **NOTICE** | Essential parts of the product can become damaged if stored improperly. |

# APPENDIX: SAFE WORKING PERIOD (SWP) CALCULATION

The end of the Safe Working Period (SWP) must be calculated in accordance with the ISO 12482-1 standard during each recurring inspection and service. If the component does not have a condition monitoring unit, use the following method to calculate the remaining SWP%.



**Note:**The values used in each SWP calculation, as well as the result and date, must be carefully recorded in the log book. Each SWP calculation requires the use of figures recorded during previous calculations.

**Step 1: Calculate the motor operating hours (running hours) per inspection interval, T i**
Check the following values for this inspection interval:

J = the number of working days during the inspection interval [days]
H = the average hoisting height [m]
N = the average number of work cycles per hour [cycles/h]
T = the average daily working time [h]
V = the maximum hoisting speed [m/min] (as shown on the data plate)

Use the following formula to calculate Ti, the motor operating hours (total lifting time) per inspection interval:

$$T_i = \frac{2*H*N*T*J}{V*60}$$

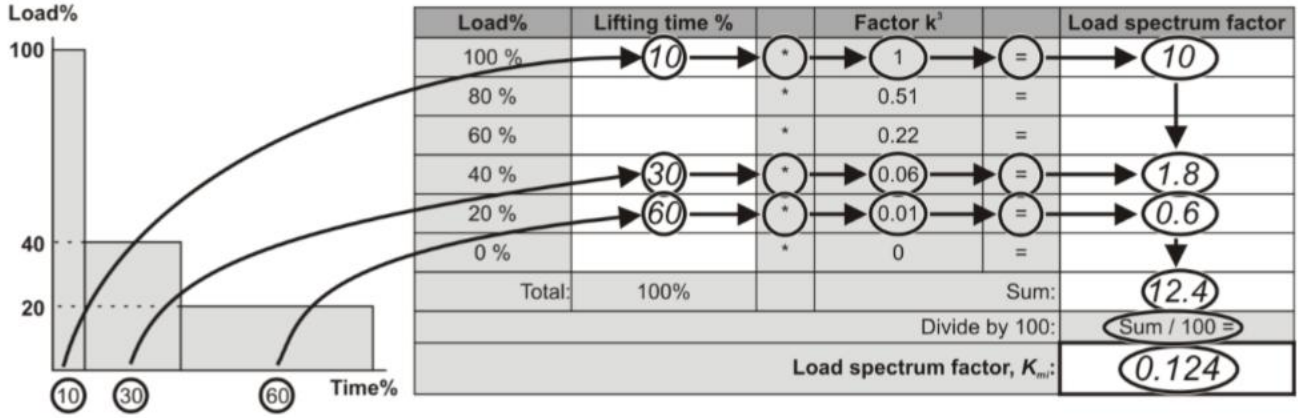
**For example**, if we use:
J = 180 [days], H = 5 [m], N = 20 [cycles/h], T = 12 [h], V = 5 [m/min]

$$T_i = \frac{2*5*20*12*180}{5*60} = 1440$$

**Step 2: Calculate the actual load spectrum factor per inspection interval, $K_{mi}$**
Divide the total lifting time in proportion to the actual load spectrum during the inspection interval. For example, if the product has lifted full loads (100%) for half of the time and no load (0%) for half of the time then record 50 for each of these in the "Lifting time %" column of the table below.

| Load% | Lifting time % | | Factor $k^3$ | | Load spectrum factor |
|---|---|---|---|---|---|
| 100% | | * | 1 | = | |
| 80% | | * | 0.51 | = | |
| 60% | | * | 0.22 | = | |
| 40% | | * | 0.06 | = | |
| 20% | | * | 0.01 | = | |
| 0% | | * | 0 | = | |
| Total: | 100% | | | Sum: | |
| | | | | Divide by 100: | Sum/100= |
| | | | | **Load spectrum factor , Kmi :** | |

The sum of the figures in the "Lifting time %" column must always be 100.
Multiply each entry in the "Lifting time %" column by the multiplier in the "Factor k3" column. Write the results in the "Load spectrum factor" column.
Add up the numbers in the "Load spectrum factor" column and record the result of this sum.
Divide the sum of the "Load spectrum factor" column by 100 to get the Kmi.
**For example**, if we use: 100% load for 10% of the time, 40% load for 30% of the time and 20% load for 60% of the time:




**Step 3: Calculate the partial duration of service, Si**

Use Ti and Kmi in the following formula to calculate Si [hours] Select the value of X, from the table below.

$$S_i = X * K_{mi} * T_i$$

| **Product** | **Value of X** |
|---|---|
| With counter and log book | 1.2 |
| With log book | 1.4 |
| Without counter, log book or CMS | 1.5 |

Record the value of Si in the log book. This value will be needed for future SWP calculations.

**For example**, if we use: X=1.2, Kmi=0.124 and Ti =1440:

$$S_i = 1.2 * 0.124 * 1440 = 214.272$$

**Step 4: Calculate the actual duration of service, S**

Add together each of the Si partial duration of service values gathered from this and previous inspection intervals since the start of the safe working period.

The earlier S values (S1…Si) can be read from the log book.

$$S = S_1 + S_2 + ... + S_i$$

**For example**, if we use S1 = 215.468, S2 = 210.26, S3 (Si) = 214.272:

$$S = 215.468 + 210.26 + 214.272 = 640$$

**Step 5: Calculate the SWP% and remaining service life**

Check the hoist operating group which can be found on the hoist's rating plate.

In the appropriate column of the following table, find the number closest to S. The two final columns on the same row will tell you the remaining SWP% and the estimated remaining service life.

| **Hoist operating group marked on hoist's rating plate** | | | | | | **SWP%** | **Estimated remaining service life [years]** |
|---|---|---|---|---|---|---|---|
| **M3 (1Bm)** | **M4 (1Am)** | **M5 (2m)** | **M6 (3m)** | **M7 (4m)** | **M8 (5m)** | | |
| **Actual duration of service , S[h]** | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 100% | 10 |
| 40 | 80 | 160 | 320 | 630 | 1250 | 90% | 9 |
| 80 | 160 | 320 | 640 | 1260 | 2500 | 80% | 8 |
| 120 | 240 | 480 | 960 | 1890 | 3750 | 70% | 7 |
| 160 | 320 | 640 | 1280 | 2520 | 5000 | 60% | 6 |
| 200 | 400 | 800 | 1600 | 3150 | 6250 | 50% | 5 |
| 240 | 480 | 960 | 1920 | 3790 | 7500 | 40% | 4 |
| 280 | 560 | 1120 | 2240 | 4410 | 8750 | 30% | 3 |
| 320 | 640 | 1280 | 2560 | 5040 | 10000 | 20% | 2 |
| 360 | 720 | 1440 | 2880 | 5670 | 11250 | 10% | 1 |
| 400 | 800 | 1600 | 3200 | 6300 | 12500 | 0% | 0 |

Record the value of SWP% in the log book.

**For example**, if we use S = 640, Hoist duty group = M5 (2m) then SWP%=60%:

| Hoist operating group marked on hoist's rating plate | | | | | | SWP% | Estimated remaining service life [years] |
|---|---|---|---|---|---|---|---|
| **M3 (1Bm)** | **M4 (1Am)** | **M5 (2m)** | **M6 (3m)** | **M7 (4m)** | **M8 (5m)** | | |
| **Actual duration of service , S[h]** | | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 100% | 10 |
| 40 | 80 | 160 | 320 | 630 | 1250 | 90% | 9 |
| 80 | 160 | 320 | 640 | 1260 | 2500 | 80% | 8 |
| 120 | 240 | 480 | 960 | 1890 | 3750 | 70% | 7 |
| 160 | 320 | 640 | 1280 | 2520 | 5000 | 60% | 6 |
| 200 | 400 | 800 | 1600 | 3150 | 6250 | 50% | 5 |
| 240 | 480 | 960 | 1920 | 3790 | 7500 | 40% | 4 |
| 280 | 560 | 1120 | 2240 | 4410 | 8750 | 30% | 3 |
| 320 | 640 | 1280 | 2560 | 5040 | 10000 | 20% | 2 |
| 360 | 720 | 1440 | 2880 | 5670 | 11250 | 10% | 1 |
| 400 | 800 | 1600 | 3200 | 6300 | 12500 | 0% | 0 |

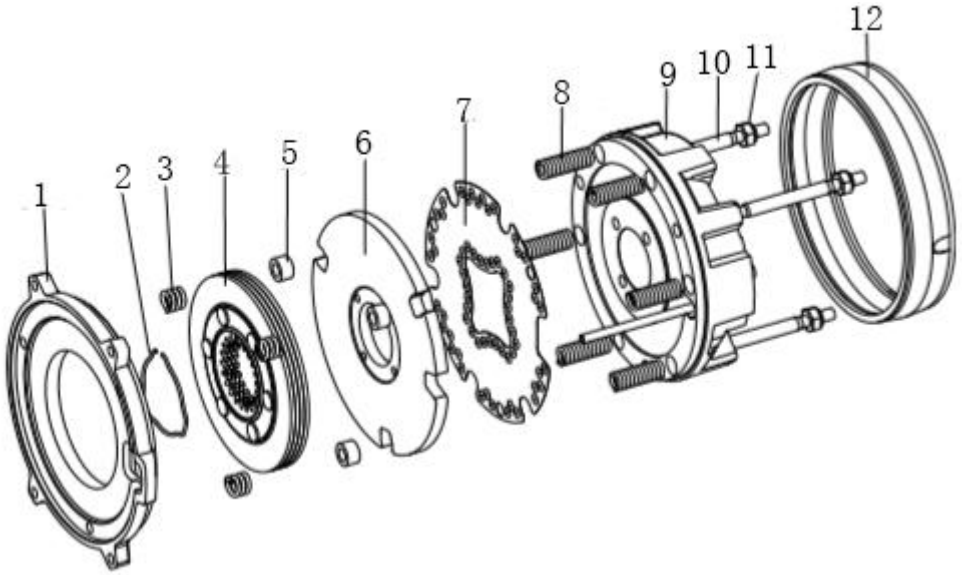
When SWP% reaches zero, a General Overhaul (GO) must be conducted. Refer to chapter 'General Overhaul (GO)'.

## APPENDIX: HOISTING BRAKE

| Unit / unit part | Frequency | What to do? |
|---|---|---|
| Brake BE5 | **If used as a working brake:**<br>At least every 3000 hours of operation | Inspect the brake<br>Measure the brake disk thickness<br>Brake disk, lining<br>Measure and set working air gap<br>Pressure plate<br>Carrier / gearing<br>Pressure rings<br>Extract the abraded matter.<br>Inspect the switch elements and change if necessary (e.g. in case of burn-out) |

| | |
|---|---|
| **DANGER** | **驱动装置意外启动可导致挤压危险。**<br>**死亡或重伤**<br>**在开始作业前，请切断电机、制动器和强冷风扇的电源，并采取措施防止意外接通！**<br>**严格遵守以下操作步骤！** |

## BE5 brakes




| | | | |
|---|---|---|---|
| 1 | Friction disc | 2 | Annular spring |
| 3 | Compression spring | 4 | Brake disk |
| 5 | Thrust ring | 6 | Pressure plate |
| 7 | Damping plate | 8 | Brake spring |
| 9 | Whole magnet | 10 | Stud |
| 11 | Hex nut | 12 | Rubber sealing collar |

## set the working air gap

1.Isolate the motor and brake from the supply, safeguarding them against unintentional power-up.

2.Remove the following:

If installed, forced cooling fan, tacho/encoder

Flange cover or fan guard

3.Push the rubber sealing collar aside [12]

Release the clip to do this, if necessary

Extract the abraded matter.

4.Measure the brake disc [4]:

If the brake disk is

≤ 9 mm on brake motors up to size 100

≤ 10 mm on brake motors up to size 112

Install a new brake disk

5.Measure the working air gap A (→ following figure)

(use a feeler gauge and measure at three points offset by 120)

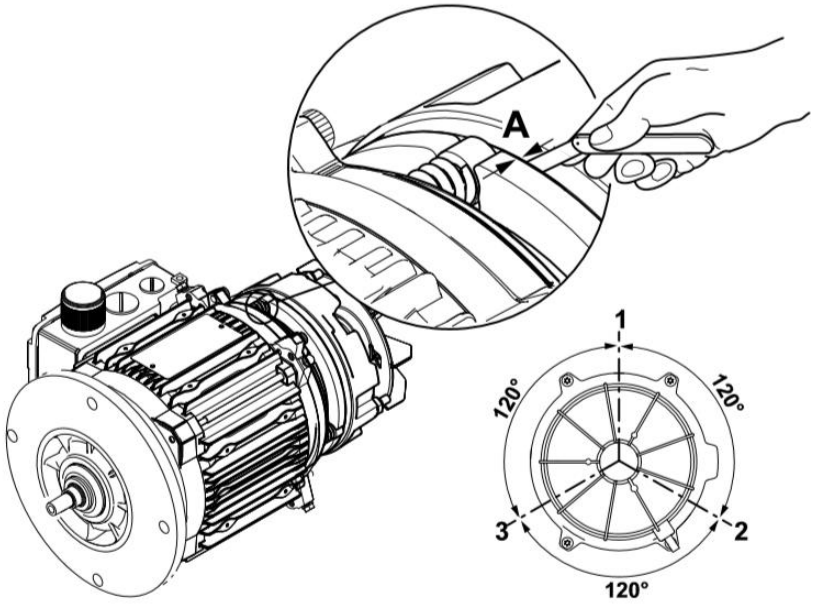
between the pressure plate [6] and the damping plate [7]

6.Tighten the hexagon nuts [11]

Until the working air gap is set correctly

7.Install the rubber sealing collar back in place and re-install the dismantled parts

| Brake type | the brake disk minimum thickness（mm） | working air gap min （mm） | working air gap max （mm） |
|---|---|---|---|
| BE5 | 9.0 | 0.25 | 0.9 |




## Changing the BE5 brake discs

When fitting a new brake disk inspect the other removed parts as well and install new ones if necessary.

1.Isolate the motor and brake from the supply, safeguarding them against unintentional power-up!

2. Remove the following:

If installed, forced cooling fan, tacho / encoder

Flange or fan guard, circlip and fan .

3.Remove the rubber sealing collar and the manual brake release:

Setting nuts [18], conical coil springs , studs , release lever , dowel pin

4.Unscrew hexagon nuts [11], carefully pull off the coil body (brake cable!) and take out the brake springs [8].

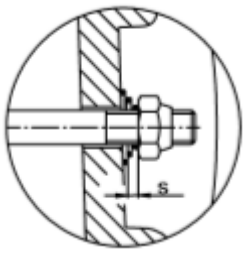
5.Remove the damping cable , pressure plate [6] and brake disc [4], clean the brake components

6. Install a new brake disk

7. Re-install the brake components

Except for the rubber sealing collar, fan and fan guard, set the working air gap

8. With manual brake release: Use setting nuts to set the floating clearance "s" between the conical coil springs (pressed flat) and the setting nuts (→ following figure)




| Brake | Floating clearance S（mm） |
|---|---|
| BE5 | 1.5 |

**Important: The floating clearance "s" is necessary so that the pressure plate can move up as the brake lining wears. Otherwise, reliable braking is not guaranteed.**

9. Install the rubber sealing collar back in place and re-install the dismantled parts.

| **NOTICE** | The self-reengaging manual brake release (type HR) can be operated with normal hand pressure. |
|---|---|

**Important: In brake motors with self-reengaging manual brake release, the manual brake release lever must be removed after startup/maintenance! A bracket is provided for storing the lever on the outside of the motor .**

**A.T.CRANE CO., LTD.**

**บริษัท เอ.ที.เครน จำกัด**

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**Document Title**

# CATALOGUE

## Project

Electric Overhead Travelling Crane Single girder Cap. 5 Tons.

จัดหาและติดตั้งเครื่องสูบน้ำ ชนิดเพลาตั้ง และจัดหาและติดตั้งระบบผลิตไฟฟ้าพลังงานแสงอาทิตย์ สำหรับงานปรับปรุงสถานีสูบน้ำด้วยไฟฟ้า 5 สถานี โครงการส่งน้ำและบำรุงรักษาบางบาล ตำบลบ้านป้อม อำเภอพระนครศรีอยุธยา จังหวัดพระนครศรีอยุธยา

(สถานีสูบน้ำโรงสูบน้ำที่ 10)

**Client**

บริษัท กรีน เทคโนโลยี เอเซีย จำกัด




**บริษัท เอ.ที.เครน จำกัด** ผู้เชี่ยวชาญด้านการออกแบบ ผลิต ติดตั้ง และบริการหลังการขาย เครนไฟฟ้า เครนโรงงาน รอกสลิงไฟฟ้าและรอกโซ่ไฟฟ้า คุณภาพมาตรฐานยุโรป ได้รับการรับรองคุณภาพมาตรฐาน ISO 9001:2015 ก่อตั้งในปี 2010 โดยผู้บริหารที่มีประสบการณ์ ในอุตสาหกรรมเครนไฟฟ้ามาตรฐานยุโรปมา เกือบ 20 ปี และมีความตั้งใจอยากให้ผู้ประกอบการทุกภาคอุตสาหกรรมได้ใช้เครนคุณภาพสูงสุด ทนทานที่สุด ในราคาที่ย่อมเยาที่สุด

เอ.ที.เครน พร้อมที่จะมุ่งมั่นพัฒนาอย่างต่อเนื่อง เพื่อให้ลูกค้าทุกท่านได้รับประโยชน์สูงสุด ดังที่บริษัทฯ ได้ตั้งปณิทานไว้

## ATC-WS

Single girder trolley,
low headroom, up to 20 t.



ข้อ1,2

## ATC-WD

Double girder trolley,
up to 63 t.



## ATC-WW

Winch, up to 100 t.



## ATC-CH

Electric chain hoist, up to 5 t.

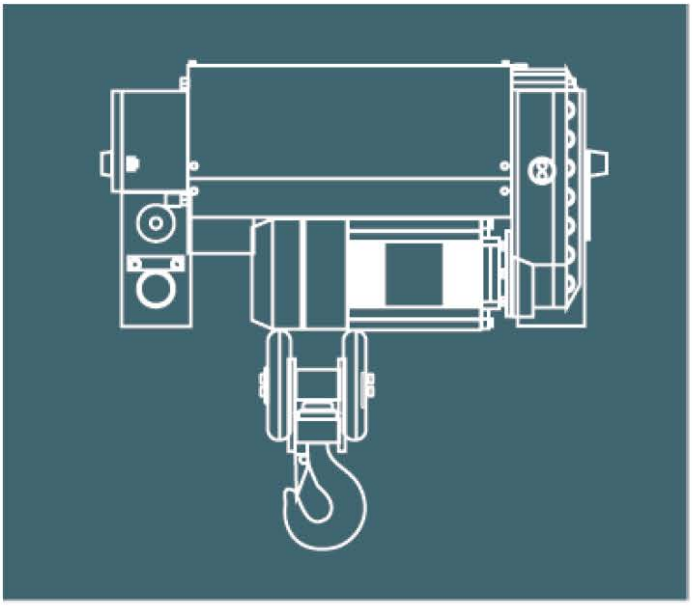


**บริษัท เอ.ที.เครน จำกัด**
123/101 ฟิฟธ์ เอเวนิว ลาดกระบัง ถนนฉลองกรุง แขวงลำปลาทิว เขตลาดกระบัง กรุงเทพฯ 10520
โทร. 092-498-1818, 02-130-0834 ไลน์ @a.t.crane www.atcrane.co.th
www.facebook.com/ATCraneThailand info@atcrane.co.th



CRANE LIFTING MACHANISM

# WIRE ROPE HOIST



**ATC-WS**

Single girder trolley, up to 20 tons

**ATC-WD**

Double girder trolley, up to 63 tons

**ATC-WW**

Winch, up to 100 Tons

## A.T.CRANE HOIST FEATURES

ข้อ7.9

### Electric Unit

- Standard control voltage 48V
- Control panel IP55
- Pendant control IP65, applicable to dust, rain, and outdoor operating environment.





### Rope Guider

- Use special high-strength nylon which light weight
- Good wear resistance
- Prevent wire rope from skipping and loosing to off-groove
- Circular design

ข้อ8

### Traveling Motor Unit

- SEW-EURODRIVE Motor (German brand)
- Protection IP55, Insulation Class F, 100%ED
- Compact structure, small size and light weight
- Direct drive flexible design, stable torque transfer
- Safe and reliable DC brake







### Lifting Motor Unit

- SEW-EURODRIVE Motor (German brand)
- Protection IP55, Insulation Class F, 60%ED
- Thermal protecting function to prevent from over temperature
- Free maintenance design, no need to change lubrication oil in lifetime
- DC brake, quick response

ข้อ10



### Hook Assembly

- Match to DIN Standard, forged by high strength alloy steel
- Safety latch to protect safely
- 360° horizontal operation easily
- Safety clasp and wire rope sheath ergonomic design



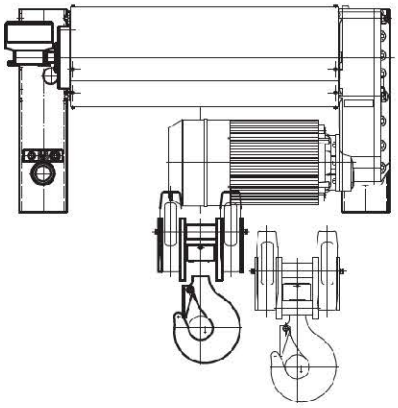
### Wire Rope

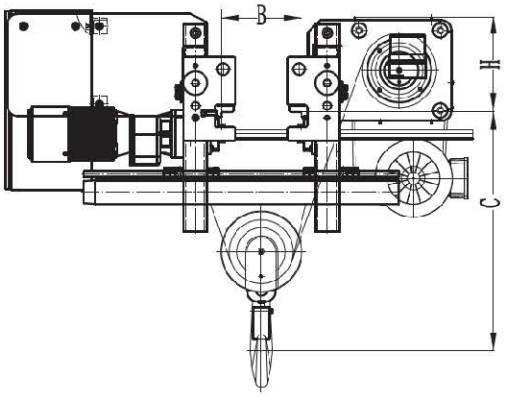
- Imported from United Kingdom
- High strength pressed solid galvanized wire rope
- 2160N/mm² tensile strength
- Good flexibility and long service life

## ATC-WS

Single girder trolley, up to 20 tons








ข้อ2,7.2.,7.3.1,7.6.1-7.6.3,7.7.1-7.7.3

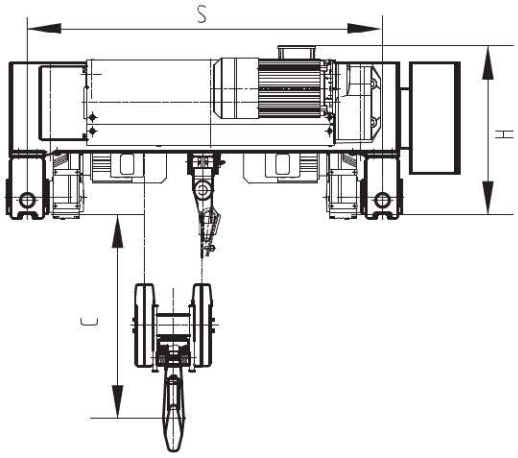
| Capacity (t) | Lifting Height (m) | Lifting Speed (m/min) | Rope Reeving | Lifting Power (kW) | Travel Speed (m/min) | Travel Power (kW) | Work Duty FEM/ISO | | H (min) | C (min) | Rail Gauge B (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 6/9/12/15/18 | 5/0.8 | 4/1 | 3.6/0.55 | 5/20 | 0.37 | 3m | M6 | 210 | 556 | 150-300 |
| 3.2 | 6/9/12/15/18 | 5/0.8 | 4/1 | 3.6/0.55 | 5/20 | 0.37 | 2m | M5 | 210 | 556 | 150-300 |
| 5 | 6/9/12/15/18 | 5/0.8 | 4/1 | 6.1/0.9 | 5/20 | 0.37 | 2m | M5 | 260 | 596 | 200-350 |
| 6.3 | 6/9/12/15/18 | 5/0.8 | 4/1 | 6.1/0.9 | 5/20 | 0.37 | 1Am | M4 | 260 | 596 | 200-350 |
| 8 | 6/9/12/15/18 | 5/0.8 | 4/1 | 9.0/1.4 | 5/20 | 0.55 | 3m | M6 | 325 | 750 | 200-410 |
| 10 | 6/9/12/15/18 | 5/0.8 | 4/1 | 9.0/1.4 | 5/20 | 0.55 | 2m | M5 | 325 | 750 | 200-410 |
| 12.5 | 6/9/12/15/18 | 5/0.8 | 4/1 | 11.0/1.8 | 5/20 | 0.55 | 1Am | M4 | 325 | 750 | 200-410 |
| 16 | 6/9/12/15/18 | 4/0.6 | 4/1 | 15.0/2.3 | 5/20 | 0.55x2 | 2m | M5 | 400 | 920 | 300-450 |
| 20 | 6/9/12/15/18 | 4/0.6 | 4/1 | 15.0/2.3 | 5/20 | 0.55x2 | 1Am | M4 | 400 | 920 | 300-450 |

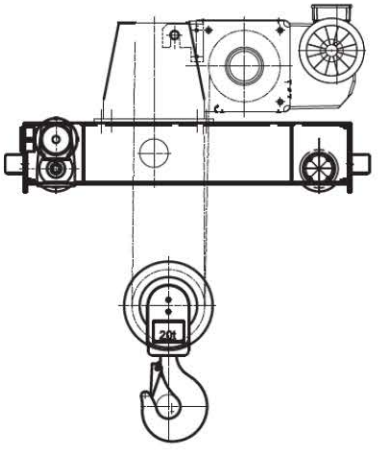
***Other technical specification can be customized upon customer requirement. Please refer to Technical Data.

## ATC-WD

Double girder trolley, up to 63 tons



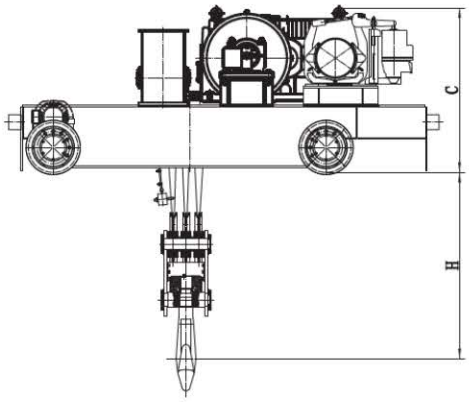
| Capacity (t) | Lifting Height (m) | Lifting Speed (m/min) | Rope Reeving | Lifitng Power (kW) | Travel Speed (m/min) | Travel Power (kW) | Work Duty FEM/ISO | | H (mm) | C (mm) | Rail Gauge S(mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.2 | 6/9/12/15/18 | 5/0.8 | 4/1 | 3.3/0.5 | 20/5 | 0.25×2 | 2m | M5 | 500 | 420 | 1400~2000 |
| 5 | 6/9/12/15/18 | 5/0.8 | 4/1 | 6.1/1 | 20/5 | 0.37×2 | 2m | M5 | 520 | 425 | 1400~2000 |
| 6.3 | 6/9/12/15/18 | 5/0.8 | 4/1 | 6.1/1 | 20/5 | 0.37×2 | 1Am | M4 | 520 | 425 | 1400~2000 |
| 8 | 6/9/12/15/18 | 5/0.8 | 4/1 | 9.5/1.5 | 20/5 | 0.37×2 | 3m | M6 | 550 | 500 | 1400~2000 |
| 10 | 6/9/12/15/18 | 5/0.8 | 4/1 | 9.5/1.5 | 20/5 | 0.37×2 | 2m | M5 | 550 | 500 | 1400~2000 |
| 12.5 | 6/9/12/15/18 | 5/0.8 | 4/1 | 12.5/2 | 20/5 | 0.55×2 | 1Am | M4 | 550 | 580 | 1400~2000 |
| 16 | 6/9/12/15/18 | 4/0.6 | 4/1 | 15/2.5 | 20/5 | 0.95×2 | 2m | M5 | 720 | 920 | 1400~2400 |
| 20 | 6/9/12/15/18 | 4/0.6 | 4/1 | 15/2.5 | 20/5 | 0.95×2 | 1Am | M4 | 720 | 920 | 1400~2400 |
| 20 | 6/9/12/15/18 | 4/0.6 | 8/2 | 15/2.5 | 20/5 | 0.95×2 | 2m | M5 | 720 | 920 | 1700~2700 |
| 25 | 6/9/12/15/18 | 2.8/0.5 | 12/2 | 18/3 | 20/5 | 1.1×2 | 2m | M5 | 850 | 800 | 1700~3500 |
| 32 | 6/9/12/15/18 | 2.8/0.5 | 12/2 | 18/3 | 20/5 | 1.5×2 | 1Am | M4 | 850 | 800 | 1700~3500 |
| 32 | 6/9/12/15/18 | 3.2/0.7 | 16/2 | 22/5 | 20/5 | 1.5×2 | 3m | M6 | 1025 | 800 | 1700~3600 |
| 40 | 6/9/12/15/18 | 2.8/0.6 | 16/2 | 22/5 | 20/5 | 1.5×2 | 2m | M5 | 1025 | 800 | 1700~3600 |
| 50 | 6/9/12/15/18 | 2/0.5 | 16/2 | 22/5 | 20/5 | 2.2×2 | 1Am | M4 | 1090 | 750 | 1700~3600 |
| 50 | 6/9/12/15/18 | 0.7-3.3 | 12/2 | 38 | 20/5 | 2.2×2 | 2m | M5 | 1090 | 800 | 2200~3600 |
| 63 | 6/9/12/15/18 | 0.7-3.3 | 12/2 | 38 | 20/5 | 3×2 | 1Am | M4 | 1090 | 800 | 2200~3600 |

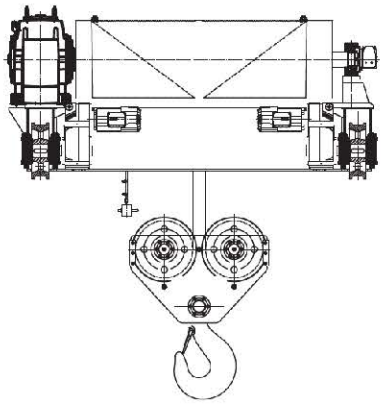
***Other technical specification can be customized upon customer requirement. Please refer to Technical Data.

## ATC-WW

Winch, up to 100 Tons





| Capacity (t) | Lifting Height (m) | Lifting Speed (m/min) | Power of Lifting (kw) | Traveling speed (m/min) | Power of Traveling (kw) | Work Duty FEM/ISO | Rail Distance (mm) | C (mm) | H (mm) | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 12 | 0.8~8 | 15 | 2~20 | 0.55×2 | 3m/M6 | 1600 | 805 | 1000 | 1960 |
| | 18 | | | | | | 2000 | | | 2106 |
| 16 | 12 | 0.78~7.8 | 22 | 2~20 | 0.75×2 | 3m/M6 | 2000 | 895 | 1200 | 2847 |
| | 18 | | | | | | 2400 | | | 2996 |
| 20 | 12 | 0.6~6 | 22 | 2~20 | 0.75×2 | 3m/M6 | 2000 | 965 | 1250 | 3295 |
| | 18 | | | | | | 2500 | | | 3480 |
| 25 | 12 | 0.5~5 | 22 | 2~20 | 1.1×2 | 3m/M6 | 2000 | 990 | 1300 | 3886 |
| | 18 | | | | | | 2600 | | | 4152 |
| 32 | 12 | 0.5~5 | 30 | 2~20 | 1.5×2 | 3m/M6 | 2200 | 1000 | 1350 | 4428 |
| | 15 | | | | | | 2600 | | | 4610 |
| | 18 | | | | | | 3000 | | | 4802 |
| 40 | 12 | 0.4~4 | 30 | 2~20 | 1.5×2 | 3m/M6 | 2200 | 1030 | 1400 | 4095 |
| | 15 | | | | | | 2600 | | | 5364 |
| | 18 | | | | | | 3000 | | | 5667 |
| 50 | 12 | 0.4~4 | 37 | 2~20 | 2.2×2 | 3m/M6 | 2500 | 1160 | 1450 | 6582 |
| | 15 | | | | | | 2800 | | | 6845 |
| | 18 | | | | | | 3200 | | | 7090 |
| 63 | 12 | 0.4~4 | 45 | 2~20 | 3.0×2 | 3m/M6 | 2500 | 1299 | 1550 | 7656 |
| | 15 | | | | | | 3000 | | | 8012 |
| | 18 | | | | | | 3500 | | | 8368 |
| 80 | 12 | 0.4~4 | 55 | 2~20 | 3.0×2 | 3m/M6 | 3000 | 1249 | 1650 | 10527 |
| | 15 | | | | | | 3500 | | | 10975 |
| | 18 | | | | | | 4000 | | | 11423 |
| 100 | 12 | 0.4~4 | 75 | 2~20 | 4.0×2 | 3m/M6 | 3000 | 1370 | 1800 | 12542 |
| | 15 | | | | | | 3500 | | | 13088 |
| | 18 | | | | | | 4000 | | | 13636 |

***Other technical specification can be customized upon customer requirement. Please refer to Technical Data.

## PREVENTIVE MAINTENANCE

# งานบริการหลังการขาย

บริการซ่อมบำรุงเชิงป้องกัน บริการทดสอบน้ำหนักรายครั้ง รายปี พร้อมออกเอกสารรับรองความปลอดภัย
โดยสามัญวิศวกรเครื่องกล ปจ. 1 ตามประกาศกรมสวัสดิการและคุ้มครองแรงงาน

### การทดสอบเครน

| | |
|---|---|
| ขนาดพิกัดยก 1 - 3 ตัน | ตรวจเช็คปีละ 1 ครั้ง |
| ขนาดพิกัดยก 3 - 50 ตัน | ตรวจเช็คปีละ 2 ครั้ง (ทุก 6 เดือน) |
| ขนาดพิกัดยก 50 ตัน ขึ้นไป | ตรวจเช็คปีละ 4 ครั้ง (ทุก 3 เดือน) |

### Preventive Maintenance

บริการซ่อมบำรุงเชิงป้องกัน

ตรวจเช็ค 50 รายการ












### กฎหมายที่เกี่ยวข้อง

กฎกระทรวง กำหนดมาตรฐานในการบริหารและจัดการด้านความปลอดภัย อาชีวอนามัยและสภาพแวดล้อมในการทำงาน เกี่ยวกับเครื่องจักร ปั้นจั่น และหม้อน้ำ พ.ศ.2552

ประกาศกรมสวัสดิการฯ เรื่อง หลักเกณฑ์และวิธีการทดสอบส่วนประกอบและอุปกรณ์ของปั้นจั่น พ.ศ.2554

นายจ้างหรือผู้ประกอบการต้องจัดให้มีเอกสารรับรองความปลอดภัย ตามประกาศของกรมสวัสดิการและคุ้มครองแรงงาน โดยต้องมีวิศวกรเครื่องกลเป็นผู้ดูแลการทดสอบและเซ็นต์รับรองในเอกสาร โดยต้องมีภาพถ่ายของวิศวกรขณะทำการทดสอบปั้นจั่น และสำเนาใบอนุญาตประกอบวิชาชีพวิศวกรรมควบคุม และเก็บไว้เป็นหลักฐานให้พนักงานกระทรวงแรงงานสามารถตรวจสอบได้ หากฝ่าฝืนไม่ปฏิบัติตามกฎของกระทรวงจะต้องระวางโทษจำคุกไม่เกิน 1 ปี หรือปรับไม่เกิน 400,000 บาท หรือทั้งจำทั้งปรับ




A.T.CRANE
Hoists & Cranes Professional

**A.T.CRANE CO., LTD.**
123/101 Fifth Avenue Ladkrabang,
Chalong Krung Road, Lamplathew, Ladkrabang Bangkok 10520
Tel. 063-661-9998, 02-130-0834 Fax. 02-130-0835

www.atcrane.co.th | www.facebook.com/atcranethailand

**A.T.CRANE CO., LTD.**

**บริษัท เอ.ที.เครน จำกัด**

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**Document Title**

# CERTIFICATE

## Project

Electric Overhead Travelling Crane Single girder Cap. 5 Tons.

จัดหาและติดตั้งเครื่องสูบน้ำ ชนิดเพลาตั้ง และจัดหาและติดตั้งระบบผลิตไฟฟ้าพลังงานแสงอาทิตย์ สำหรับงานปรับปรุงสถานีสูบน้ำด้วยไฟฟ้า 5 สถานี โครงการส่งน้ำและบำรุงรักษาบางบาล ตำบลบ้านป้อม อำเภอพระนครศรีอยุธยา จังหวัดพระนครศรีอยุธยา

(สถานีสูบน้ำโรงสูบน้ำที่ 10)

**Client**

บริษัท กรีน เทคโนโลยี เอเซีย จำกัด

# Quality Certificate

**Basic Information**

| | | | |
|---|---|---|---|
| Model Name | ATC-WS-5T-M5-9m | Reeving No | 4/1 |
| Product ID | ATC-WS-240753003 | Lifting Capacity (t) | 5 |
| Lifting height(m) | 9 | Duty Group(FEM/ISO) | 2m/M5 |
| Total current(A) | 15. 2 | Total Power(kW) | 6. 47 |
| **Hoisting** | | | |
| Lifting Motor Model | DR2S132S12/2/BE5HR/TH | | |
| Power（kW） | 6.1/0.9 | Insulation class | F |
| Duty Cycle(ED) | S4 15%-30% | Protection class | IP55 |
| Lifting Gear Model | G77 DR2S132S12/2/BE5HR/TH | | |
| Gear ratio（i） | 76.60 | | |
| Lifting Speed (m/min) | 5/0.8 | | |
| **Trolley** | | | |
| Trolley Motor Model | DRN80MK4/BE1HF | | |
| Power（kW） | 0.37 | Insulation class | F |
| Duty Cycle(ED) | S1-100% | Protection class | IP55 |
| Lifting Gear Model | RF17DRN80MK4/BE1HF | | |
| Gear ratio（i） | 10.15 | | |
| Rail Gauge (mm) | / | Wheel Groove(mm) | / |
| Cross Travel Speed(m/min) | 5-20 | | |
| **Controls** | | | |
| Main Voltage | 380V/3P/50HZ | Control Voltage | 48V |
| Lifting Inverter model | | Trolley Inverter Model | ATV320U15N4C |

**Quality Check Result:**

**The product is qualified for delivery.**

**Report Date:** 10-Aug-24

QC Signature: