



Technical Standard

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Mondi AG.

Mondi Standard Harmonization

ELECTRICAL, AUTOMATION AND INSTRUMENTATION INSTRUCTIONS FOR MACHINE DELIVERIES

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ABBREVIATIONS

AC	Alternative Current
AI	Analog Input
ANSI/ISA	American National Standards Institute / International Society of Automation
AO	Analog Output
ATEX	ATmosphères EXplosibles, explosive atmospheres
brown field	rebuilt, existing process area
CE	Conformité Européenne, European conformity
CENELEC	European Committee for Electrotechnical Standardization
CM	Condition Monitoring
CPU	Central Processing Unit
DC	Direct Current
DCS	Distributed Control System
DDL	Data Definition Language
DI	Digital Input
DIN	Deutsches Institut für Normung, German Institute for Standardization
DN	Diameter Nominal
DO	Digital Output
DTC	Direct Torque Control
DTM	Device Type Manager
dwg	AutoCAD format
e.g.	exempli gratia, for example
EC	European Commission
EDDL	Electronic Device Description
EHSR	Essential Health and Safety Requirements
EIA	Electrical, Instrumentation and Automation
EMC	Electromagnetic Compatibility
EN	European Standard
etc.	et cetera, and other similar things
EU	European Union
EU-MEPS	European Minimum Energy Performance Standard
Ex-area	Explosive area
FAT	Factory Acceptance Test

FDT	Field Device Tool
FE	Functional Earth
green field	new process area
HART	Highway Addressable Remote Transducer
HD	Harmonization Documents
HMI	Human Machine Interface
HTML	HyperText Markup Language
HV	High Voltage
i.e.	id est, that is
I/O	Input/Output
ICT	Information and Communications Technology
IEC	International Electrotechnical Commission
IP	Ingress Protection
ISO	International Organization for Standardization
IT	Information Technology
LED	Light-Emitting Diode
LV	Low Voltage
MCC	Motor Control Center
MCS	Machine Control System
MV	Medium Voltage
ND-end	Non drive end
OPC	Open Platform Communications
OT	Operational Technology
PE	Protective Earth
PED	Pressure Equipment Directive
PELV	Protected Extra-Low Voltage
PIMS	Process Information Management System
PLC	Programmable Logic Controller
PWM	Pulse Width Modulation
QCS	Quality Control System
SIL	Safety Integrity Level
SIS	Safety Instrumented System
SPM	Shock Pulse Method
SRS	Safety Related System

TCP/IP	Transmission Control Protocol/Internet Protocol
TN-S	Terra Neutral Separate
UPS	Uninterruptible Power Supply
VAC	Volts Alternative Current
VDC	Volts Direct Current
VFD	Variable-Frequency Drive
VSD	Variable Speed Drive
WBS	Web Break System
WIS	Web Inspection System

1 GENERAL

The plant operates continuously throughout the year. It has to be possible to repair a piece of equipment without interrupting the process. Special attention has to be paid to easy replacement of faulty devices and components.

1.1 Purpose

This document defines the general principles and delivery limits of electrification, ICT, automation and instrumentation equipment between the Purchaser and the Supplier.

The equipment and installation shall fulfil the technical requirements of this document.

Any deviation from these instructions shall be notified by the Supplier and is allowed only with written agreement by the Purchaser.

1.2 Equipment Specifications

All electrical, automation and instrument equipment included in the delivery shall be clearly specified in the tender and the procurement documents.

1.3 Codes and Regulations

The equipment and installation shall comply with the following standards, regulations and instructions:

- Local authorities' regulations and recommendations
- Laws and regulations currently in force in the current country, especially:
 - 250/2021 Sb. „Zákon o bezpečnosti práce v souvislosti s provozem vyhrazeným technických zařízení a o změně souvisejících zákonů“
 - NV 190/2022 Sb. „Nařízení vlády o vyhrazených technických elektrických zařízeních a požadavcích na zajištění jejich bezpečnosti“
 - NV 194/2022 Sb. „Nařízení vlády o požadavcích na odbornou způsobilost k výkonu činnosti na elektrických zařízeních a na odbornou způsobilost v elektrotechnice“
- EU norms and directives (Machine, PED, EMC, Low Voltage, ATEX, etc.)
- Project instructions
- Mill instructions
- Mondi OT Security Policy
- IEC recommendations

1.3.1 Machinery safety

The Goods shall meet all existing legislative regulations of EU and local laws and those foreseen within the supply and commissioning timescales. The Plant and installations shall comply with the Machine directive 2006/42/EC, Low Voltage Directive 2014/35/EU and Electromagnetic Compatibility (EMC) Directive 2014/30 EU and be appropriately CE marked. All machinery will have to satisfy the Essential Health and Safety Requirements (EHSR) of this directive and any other safety regulations or special orders given in the form of standards. All inspections and quality controls required by the authorities before the test run in case of turn key projects shall be covered by the Supplier - otherwise costs to be covered by Purchaser. The costs of necessary X-ray inspection shall be included in the Tender.

In the cases, where the definition of machinery is according to “assembly of machines”, the Supplier of the main equipment is responsible for the complete EU declaration and CE marking.

The delivery of the Supplier includes the safety integration of the machinery with instructions for safe operation, installation and maintenance as well as risk assessment which is one of the obligations set forth for the machine manufacturer in the machine directive 2006/42/EC in order to declare EC conformity and affix CE marking. Further the delivery of the Supplier includes the EC declaration of conformity type IIA and CE marking in accordance with the machinery directive 2006/42/EC. For this purpose, the Purchaser delivers for the Supplier the EC manufacturer’s declaration type IIB of the motors and the conformity declarations according to LV and the EMC directive of the electrical and control equipment, which the Purchaser has bought from a third party according to the specifications by the Supplier.

1.3.2 Functional Safety

International Generic Functional Safety Standard EN / IEC 61508 (Functional safety of electrical/-electronic/programmable electronic safety related systems) and the Technical Application Standard EN / IEC 61511 (Safety Instrumented Systems for the process industry sector) require complying with the safety life cycle model described in these standards in everything, which deals with operational safety.

The standard requires leading the requirements from the analyzed risks, to carry out the design fulfilling all the requirements, verifying and qualifying the various design stages. Operation and maintenance instructions shall ensure that the required level of security is maintained throughout the plant life cycle.

1.3.3 ATEX Classification

ATEX (Atmosphere Explosible) classification for each Ex-area shall be made according to standards IEC 60079-10-1 (Explosive atmospheres - Part 10-1: Classification of areas - Explosive gas atmospheres) and IEC 60079-10-2 (Explosive atmospheres - Part 10-2: Classification of areas - Explosive dust atmospheres).

ATEX Zone classifications to zones 0, 1 and 2 for the explosive gases and liquids and zones 20, 21 and 22 for the inflammable dusts and powders shall be specified in the clarification. Ex-areas shall be presented in layout drawings with necessary sectional views in such a way that exact limits of the Ex-areas are clearly indicated there.

Qualities of the explosive gases and liquids as well as the dusts and powders shall be specified in the clarification. At least the flashing point, auto ignition temperature, explosion limits, temperature class and explosion group shall be informed.

The electrical and mechanical equipment for the Ex-areas shall be specified according to standards IEC 60079-0 (Explosive atmospheres - Part 0: Equipment - General requirements), IEC 60079-14 (Explosive atmospheres - Part 14: Electrical installations design, selection and erection) and ISO 80079-36 (Explosive atmospheres - Part 36: Non-electrical equipment for explosive atmospheres)

1.4 References

Machine directive 2006/42/EC

Low Voltage Directive 2014/35/EU

Electromagnetic Compatibility (EMC) Directive 2014/30/EU

MEIA0002	Recommended Manufacturers for Electrical and Instrument Equipment
MEIA0005	Cable standard
MEIA0007	Instrument and Automation Installation Standard
MEIA0008	Electrical Installation Standard
MG0001	General Mill Specifications Summary
IEC 60034-30-1:2014	Rotating electrical machines - Part 30-1: Efficiency classes of line operated AC motors
IEC 60072-1:1991	Dimensions and Output Series for Rotating Electrical Machines - Part 1: Frame Numbers 56 To 400 And Flange Numbers 55 To 1080
IEC60072-2:1990	Dimensions and Output Series for Rotating Electrical Machines - Part 2: Frame Numbers 355 To 1000 And Flange Numbers 1180 To 2360
IEC60072-3:1994	Dimensions and Output Series for Rotating Electrical Machines - Part 3: Small Built-In Motors - Flange Numbers BF10 To BF50
IEC 60079-0:2009	Explosive atmospheres - Part 0: Equipment - General requirements
IEC 60079-10-1:2020	Explosive atmospheres - Part 10-1: Classification of areas - Explosive gas atmospheres

IEC 60079-10-2:2015	Explosive atmospheres - Part 10-2: Classification of areas - Explosive dust atmospheres
IEC 60079-14:2013	Explosive atmospheres - Part 14: Electrical installations design, selection and erection
ISO 80079-36:2016	Explosive atmospheres - Part 36: Non-electrical equipment for explosive atmospheres
IEC 61508:2010	Functional safety of electrical/-electronic/programmable electronic safety related systems
IEC 61511:2020	Functional safety - Safety instrumented systems for the process industry sector
EN 10204	Metallic products. Types of inspection documents
ANSI/ISA 71.04-2013	Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants

1.5 Engineering

The required engineering within the Supplier's delivery scope has to follow International standard and Best engineering practice.

1.6 Process Control

The process is remotely controlled from control rooms with DCS (Distributed Control System) operator stations. Graphic displays are used for process control and operation.

User interface for the MCS (Machine Control System), QCS (Quality Control System) and SIS (Safety Instrumented System) shall be integrated to the DCS operator stations. WIS (Web Inspection System), WBS (Web Break System), CM (Condition Monitoring) shall be integrated to the DCS operator stations if possible in a window. There shall not be separate MCS operator stations in control room.

Trends and historian data shall be transferred to history collection serves such as PIMS (Process Information Management System).

As necessary, control panels, desks, boxes can be used for local control purposes, but will not be located in the control rooms.

2 DELIVERY LIMITS

The machine delivery shall include all electrical, Information and Communication Technology, automation and instrumentation equipment and components, which are considered to be an integrated part of the machinery or which can essentially affect the operation itself or its control.

In the brown field projects all controls shall be integrated in the mill existing DCS/MCS or otherwise agreed with Purchaser (stand alone PLCs).

2.1 Equipment, Services and Applications to be supplied by the Supplier

2.1.1 Wiring

The devices shall be wired and cabled to a termination, which is the delivery limit between the Supplier's and Purchaser's cabling.

The specification of the termination (e.g. junction box, terminal rail or control panel) will be separately agreed for each contract.

In the green field projects (new process areas) there are 3 alternatives for communication:

- Traditional hardwired signals from field or MCCs to system I/O modules in rack and electrical rooms
- Distributed I/O in the field boxes or in MCC rooms
- Profibus PA, Profibus DP and Profinet for instrumentation and device bus for motor controls

In the brown field projects (rebuilt) the existing communication protocol will be used.

The communication protocol to be decide by Purchaser in each project.

2.1.2 Electrification

All supplied equipment must be installed according to the respective manufacturer's service manual and equipment from recommended manufacturers in the standard "MEIA0002" must be used.

In turn key projects supplier delivers all equipment. Delivery limits are power supply terminals on MCC cabinet. Delivery limits will be separately agreed for each project.

In not turn key projects typical equipment and services, which shall be included in the delivery, are (will be separately agreed for each project):

- Standard motors
- Special motors such as gear motors, brake motors, etc.
- Special motor starters and automation (for example cranes, roll grinder, etc.)
- Internal cabling, internal cable trays, conduits and wiring within the equipment
- Special cables and wires
- Local control boxes
- Limit switches, photocells etc. components
- Special lighting within the equipment
- Emergency stop and safety locking devices

Delivery limits are shown on the appendix II, which shall be used as template and be customized by each mill depending on project.

2.1.3 Instrumentation

In turn key projects supplier delivers all equipment. Delivery limits are typically power and air supply. Delivery limits will be separately agreed for each project.

In not turn key project typical equipment and services, which shall be included in the delivery, are (will be separately agreed for each project):

- All the instrumentation and automation equipment and components which are considered to be an integral part of the machinery or which can essentially affect the operation itself or its control
- Local pressure, temperature (including thermo wells), flow, level, limit, position, vibration, torque, speed, etc. indicators and switches in connection to machinery, equipment or piping
- Pneumatic supply air piping from the Purchaser's air header to the machinery or equipment. The Purchaser supplies the connection at the header including the isolation valve.
- All Purchaser specified process connections with isolation valves for the delivered machinery, equipment or piping.
- Machine and equipment safety locking devices *with mechanical locking devices*
- Digital instruments are preferred where applicable.
- Operation, control or monitoring devices connected to the sealing water, lubrication, pneumatics and hydraulics systems.

Delivery limits are shown on the appendix I, which shall be used as template and be customized by each mill depending on project.

2.1.4 Automation

In turn key projects supplier delivers all equipment. Delivery limits will be separately agreed for each project.

In not turn key projects typical equipment and services, which shall be included in the delivery, are (will be separately agreed for each project):

- Machine control system (MCS) which form an integrated part of the Supplier supplied machinery (e.g. board machine, winder, etc.). These shall be agreed with the Purchaser
- Panels, desks or control boxes which may belong to the above (e.g. finishing machinery).
- In case the DCS system operator stations are used as a sole user interface, applicable bus or network interface hardware and software shall be included in the delivery. Profibus PA, Profibus DP, Profinet and Ethernet are preferred to those connections.
- The Supplier shall provide standard software interfaces (OPC, Profinet etc) for remote control and reporting. All necessary hardware and software shall be included.

- The Supplier supplied interface shall include all system signals including system diagnostics.
- Machine automation operation equipment and possible auxiliary devices such as programming devices etc.
- SRS documentation (Clarification of the scope of systems included in SRS, hazard and risk analysis and reports, specification for the overall safety requirements, safety interlocking diagrams)
- MCS Factory Acceptance Test (FAT)
- Virtual solution running on VMWare is preferred

Delivery limits are shown on the appendix I, which shall be used as template and be customized by each mill depending on project.

The installation, installation material, testing and start-up of the equipment described above in items 2.1.1, 2.1.2, 2.1.3 and 2.1.4 shall be included in the machine delivery.

2.1.5 Engineering for Control Systems

Distributed process control system (DCS) and safety instrumented system (SIS) configuration source material *which are related to the machinery in question* shall be included in the delivery. Source documents are (depending on the project):

- Process descriptions
- PI-diagrams and interlocking
- Group start, sequence and control diagrams
- Functional diagrams/descriptions (Preferred logical diagrams, functional description to be agreed by purchaser)
- Loop lists
- I/O lists

Specifications for implementing the MCS user interface to DCS operator station shall be included in the delivery.

The Supplier shall participate to DCS and SIS Factory Acceptance Test (FAT) in those part which are related to the machinery question.

2.2 Equipment to be supplied by the Purchaser in not turn key projects

The Supplier is responsible for preparing specification data for the equipment to be supplied by the Purchaser. The Supplier shall co-ordinate the issue of the purchase data with the Purchaser's procurement team to meet the delivery times.

If not otherwise stated, machine delivery shall exclude the following items (will be separately agreed for each project):

2.2.1 Electrification

- Power transformers
- MCC, MV and HV switchgear
- Power and motor cables and main cable trays
- Standard control and signal cables
- Safety switches
- Lighting fittings
- Electrical installation (power and lighting)
- Earthing PE
- Earthing FE

2.2.2 Instrumentation

- Field instruments and remote controlled valves excluded from the machine delivery
- Installation and installation material for the above

2.2.3 Automation, Systems and Information and Communication Technology

- Process control system (DCS) including operating, control and auxiliary equipment not related to the machinery in question.
- Data network infrastructure with installation
- Telephone, clock and paging equipment
- Programmable logic controller (PLC)

2.3 Equipment to be supplied by the Purchaser in turn key projects

In turn key projects delivery limits are power supply terminals on MCC cabinet. If not otherwise stated, machine delivery shall exclude the following items (will be separately agreed for each project):

- Power transformers
- MV and HV switchgear
- Purchaser's delivers electrical feeders to MCC cabinet
- Air supply

3 AMBIENT CONDITIONS AND ENCLOSURE CLASSES**3.1 General**

Plastic materials are not allowed in locations from where the plastic can get into the production process. Plastic name plates are accepted if specified in the Mill's marking and name plate standard.

All electrical and electronic devices and components included in the delivery shall be in accordance with the following enclosure classes, or they shall be enclosed so that the enclosure class of the device in question is achieved in accordance with the ambient conditions.

Equipment has to be suitable for applications in PP industry environment.

3.2 Ambient Conditions

Ambient conditions are shown on appendix of General Mill Specifications Summary MG0001.

3.3 Control, Electrical, Automation and Cable Rooms

3.3.1 Control Rooms

Temperature	+5... +28 °C
24 h average (max.)	+25 °C
Relative humidity	20... 80 %

3.3.2 Electrical Rooms

Temperature	+5... +35 °C
24 h average (max.)	+30 °C
Relative humidity	20... 80 %

3.3.3 Automation Rooms

Temperature	+5... +35 °C
24 h average (max.)	+25 °C
Relative humidity	20... 80 %

3.4 Enclosure Classes

3.4.1 Motors

– Motor enclosure	IP55
– Terminal box	IP55

3.4.2 MCCs, Boxes and Panels

– Process area	IP55
– Electrical rooms	IP21
– Electrical rooms in some cases (agree with purchaser)	IP54

3.4.3 Field Equipment

– Field instruments	IP65
– Positioners	IP65
– Local switches	IP65

– Safety switches

IP65

All electrical and electronic devices as well as components included in the delivery have to be in accordance with the above mentioned enclosure classes, or they have to be mounted in an enclosure in accordance with the ambient condition requirements.

Field junction boxes placed outside and containing sensitive electronics must be protected from direct sunshine, air purged internally, closed door sensors and temperature indication.

The Supplier shall include specification of area classification for special requirements such as ATEX process areas etc. The protection class of the electrical and instrument equipment located inside classified area must correspond to the area requirement.

4 VOLTAGES

4.1 Voltage Systems

The available electrical power supply system is a typical industrial network and the quality of the power supply will be of corresponding standard. The equipment shall be suitable for operation in these conditions and with voltage variation of -10...+10 %.

4.1.1 Motor Voltages

Motor ratings:

Voltages:

0.25 kW...630 kW

690 V, 50 Hz (TN-S system without neutral)
The terminal box connection of 0.25 kW...
630 kW is 690 V Y/ 400 VΔ.

> 630 kW, direct on-line motors

6kV or 10,5 kV, 50 Hz (Resistance earthed).

Frequency controlled motors
≤ 1600 kW

690 V, 50 Hz (TN-S system without neutral,
for single drives, IT system for sectional
drives) Maximum power limit must be agreed
with the purchaser.

Motors ≤ 0.25 kW

400 V, 50 Hz (TN-S system).
Power limits and voltages must be agreed
with Purchaser.

Small special motors

400 V or 230V, 50 Hz (TN-S system).
Voltage of small special motors shall always
be confirmed with the purchaser.

Motor voltage of small motors (≤ 4 kW) for frequency converter drives can be 400 V, 50 Hz. The voltage of small frequency converter motors shall always be confirmed with the purchaser.

The voltage of large motors > 630 kW shall always be confirmed with the purchaser.

4.1.2 Other Loads

Other loads such as tools, lighting, cranes, etc. will be connected to the distribution system of 400/230 V, 50 Hz; with solidly earthed neutral point, TN-S system. Neutral (N) and protective earth (P) shall not be connected in any part of the distribution system. The main distribution centres are supplied with monitoring devices to keep N and P apart.

Heaters for process equipment will be connected to the distribution system of 690V or 400 V. The voltage of heaters shall always be confirmed with the purchaser.

Where the machine delivery includes equipment, which requires the use of safety voltage, it shall be PELV system and voltage 24VAC, no more than 50V DC. Necessary protective transformers and other equipment (lighting fittings etc.) shall be included in the delivery. If other voltages are needed, they shall be agreed on separately.

4.1.3 Control Voltages

The control voltages will be:

–	Binary sensors	24 VDC
–	Solenoid valves, < 2.5 W, preferred	24 VDC
–	Solenoid valves, > 2.5 W	24 VDC (230 VAC in special cases)
–	MCC starter, internal	24VDC or 230 VAC
–	Safety devices on field	24 VDC (230 VAC in special cases)
–	Auxiliary voltage HV and MV switchgear	110 VDC or 220 VDC Voltage of auxiliary shall always be confirmed with the purchaser

Generally the control voltage is a solidly -earthed voltage of 230 V 50 Hz. Normally it is supplied from 690/230 V or 400/230 V control voltage transformers. For automation and electronic equipment an operational-earthed 400/230 V, 50 Hz voltage secured with UPS equipment will be used. In equipment connected to control systems, 24 V DC is used as field voltage.

Two 24 VDC power supply units (able to operate in redundant mode, one unit is large enough to supply all load) will be used for DCS.

4.1.4 Signal Ranges

In green field:

- Analog signal 4 to 20 mA DC (with Hart)
- Fieldbus Profibus PA, Profibus DP, Profinet

In brown field:

- Analog signal 4 to 20 mA DC (with Hart)

- 0 to 20 mA DC
- 0 to 10 VDC
- 0 to 20 VDC
- Fieldbus Profibus PA, Profibus DP, Profinet

In the brown field the existing communication protocol will be used. The communication protocol to be decide by Purchaser in each project.

4.2 Auxiliary Voltage Supply

- Alternating current (AC) 230 VAC
- DCS / PLC 230 VAC (UPS network)
- Direct current (DC) 24 VDC

These auxiliary voltage supplies will be supplied by a centralised UPS arranged in redundant solution.

4.3 Air Supplies

There are two oil free air networks available

- Mill air / Instrument air 6.0 bar (a) nominal
7.0 bar (a) maximum

Actuators have to be sized to function at 5 bar (a), critical applications at 4 bar.

If the equipment requires a supply pressure lower than the nominal pressure of the system, a combined filter/pressure reducer shall be included. If there are several pieces of equipment in the same area, a common double filter/pressure reducing station can be used to supply multiple equipment.

Equipment requiring oil lubrication is not to be used where a no lubrication alternative exists.

4.3.1 Earthing

The Supplier's equipment for 400 V shall be built according to the TN-S system. TN-S system neutral (N) and protective earth (PE) shall not be connected together at any part of the distribution system other than at the main distribution centre.

The Supplier's electrical equipment will be connected to the mill protective (PE) and signal-earthing (FE) network on the mill site. The Supplier shall take care that the protective earth and signal earth are kept separate in his equipment.

The supplier shall specify requirements for earthing of machinery and electrical/automation equipment in their scope.

Screened signal cables shall be used for low voltage signals. The screen will be connected to signal-earthing (FE) in electrical or rack rooms. The screen will be isolated in the field end.

5 MOTORS

5.1 General

The Purchaser reserves the right to select the manufacturer of motors.

Motors should be suitable for heavy industrial use

Only direct-on-line squirrel cage induction will be used. The use of other types must be discussed with the Purchaser. High efficiency motors must be used.

The Supplier shall present the test records of the motors upon Purchaser's request.

Special and high- output motors shall be approved by the Purchaser.

5.2 Standards

The frames and shaft extensions of the 400/690 V motors have to comply with the IEC recommendations 60072-1, 60072-2 and 60072-3. The electrical characteristics have to be in accordance with the CENELEC specifications HD 231. Motor sizes will be selected from the following series: 0.25, 0.37, 0.55, 0.75, 1.1, 1.5, 2.2, 3.0, 4.0, 5.5, 7.5, 11, 15, 18.5, 22, 30, 37, 45, 55, 75, 90, 110, 132, 160, 200, 250, 315, 400, 500 and 630 kW.

5.3 Efficiency

0,75 - 1000kW motors shall be at least efficiency class IE3 (premium efficiency) and 0,12 -055kW motors shall be at least efficiency class IE2 according to IEC 60034-30-1 (Rotating electrical machines - Part 30-1: Efficiency classes of line operated AC motors).

5.4 Frame Structure

The terminal box and terminals shall be built according to Project motor cable standard. Cable glands and angle adaptor shall be included.

Frequency converter driven motor cable glands shall be meet EMC installation instructions and be appropriated for shielded cables

Preference is for top mounted main terminal boxes with cable entry from any direction except the top. If this is not possible, terminal boxes shall be located on the left-hand side, viewed from load coupling side of motor, with cable entry from front, back or bottom of the box.

All motors should be cast iron. Deviations must be accepted by the purchaser.

First choice shall be the use of foot mounted, horizontal motors (B3).

Flanged motors shall be equipped with feet (B3/B5 or B3/V1).

All totally enclosed frames shall be provided with a drain hole and threaded plug at the low point. All motors shall be built in IEC standard frames.

For squirrel cage motors 690 V / 400 V (≤ 630 kW) the fan must be so designed that the motor can rotate in both directions without change of fan.

5.5 Dimensioning

Sufficient reserve power (about 15 %), exceptional use (long starting time, frequent starts, jogging) and ambient temperature at the motor location (over $+35^{\circ}\text{C}$) have to be taken into account in motor selection. Considerable over sizing should however be avoided.

IC 411 motors will be used whenever it is possible.

The motors shall be of insulation class F with class B ($+80^{\circ}\text{C}$) temperature rise.

Primarily four-pole motors (1500 l/min) and secondarily six-pole motors (1000 l/min) shall be used.

The manufacturer's instructions concerning the bearings and shaft ends have to be checked for the suitability of belt drive.

The motor foundation stud for the motor shall be large enough to receive the next larger standard rating. If the shaft height of the next-size motor is higher, the motor shall be installed on intermediate plates, which can be removed should change of the motor be required. Necessary intermediate plates are part of the machine delivery.

In hot environments special greases need to be taken into consideration

5.6 Accessories of Motors

6 kV and 10,5 kV motors shall be equipped with winding and bearing Pt 100 or Pt 1000 temperature sensors. Motors shall be equipped with doubled Pt 100 or Pt 1000 temperature sensors in windings. The first element will be used and the other will be spare.

The Supplier shall ensure that harmful effects of bearing currents are avoided in all motors.

Motors $\geq 7,5$ kW shall be equipped with temperature sensors (2xPt 100 or Pt 1000), the first element will be used and the other will be spare.

Frame size IEC100 and larger motors shall be equipped with re-lubrication nipple.

Frame size IEC 160 and larger motors shall be equipped with vibration monitoring test points (SPM) and condensate drain holes.

All motors must have stainless steel rating plate which must also specify all the special characteristics and installed options of the motor.

In frequency converter drives, if the motor ventilation is not enough at low speed, a higher power motor or a separate fan can be selected. The decision shall be agreed with the purchaser.

Frequency converter driven 690 V motors shall be equipped with reinforced insulation. ND-end insulated bearings or bearing shields shall be installed in frequency converter motors (both 400 V and 690 V) According to the motor manufacturer's instructions and motor bearings shall be able to run with 100Hz frequency. Insulated bearings has to be use with FC from axial height 280 mm.

An additional earthing terminal shall be provided on the motor frame.

Motor resonance frequency of motors shall be taken into consideration.

Vertical motors shall be protected with a protection cap.

No terminal blocks shall be allowed. Instead, flexible leads with eye-type cable connectors shall be supplied.

A stud with two nuts shall be provided inside the terminal box for earthing protection conductor (PE).

Lifting devices, such as eyebolts or lugs, shall be provided on all motors.

5.7 Rating and Nameplates

All motor nameplates, marked per EU-MEPS (European Minimum Energy Performance Standard), shall be made of stainless steel or approved equal. In addition, they shall identify each bearing by the manufactures designation or approved equal. The motor weight shall be included on nameplate.

Name plates, identification codes and labels/tagging etc. shall be according to the Purchaser's instructions and those shall be approved by the Purchaser.

Mounting and delivery of additional info/rating plate is included.

5.8 Protective coating and painting

The external surfaces shall be treated to withstand heavy industrial environmental conditions.

The protective coating and corrosion protection of the motor shall be described by the Supplier in his tender.

All external parts of the frames that will be exposed to ambient shall be protected against corrosion by sufficient painting.

Sufficient corrosion protection shall be applied to the internal parts.

All electrical motors shall be painted following manufacturer's standard.

The colour of the final painting shall be approved by Purchaser.

5.9 Motor List

The supplier shall prepare a motor list, which has to comprise all motors included or excluded in the machine delivery. The list has to state the motor supplier (Supplier or Purchaser) as well as recommended power, speed, motor mounting and if belt driven.

Motor list shall include information how many I/O's (DI, DO, AI...) are required with an indication for what purpose the I/O is used (motor speed, start, set point, current...). Only valid for traditional hardwired I/O's.

For the correct selection of motors and starters the list has to include starting time and frequency, possible braking requirement, speed control, reversing, torque type and requirements and necessary information about axial and radial forces (for instance in case of belt driven or direct mounted fan impeller) as well as coupling type.

5.10 Motor Protection in Wet Conditions

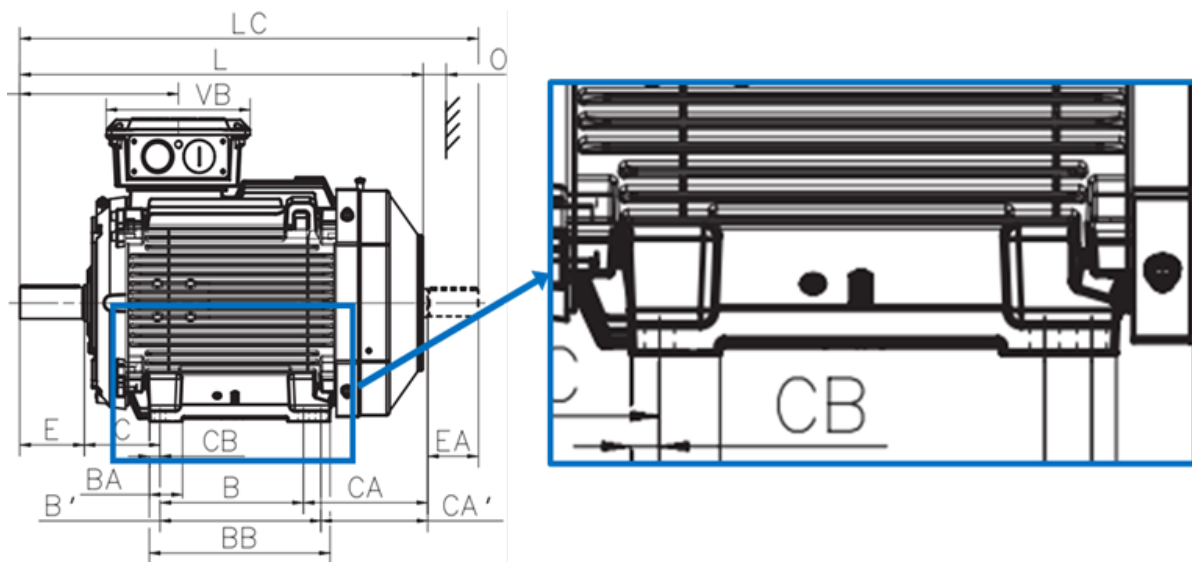
Splash-proof, reinforced plastic rain covers shall be specified for the motors exposed to rain or splash water. A minimum of 100 mm of free space shall be allowed in front of the motor fan cover.

Also motors which are located near tanks etc., where overflow or leakage from i.e. maintenance holes can cause splashes, shall be equipped with weather protection, refer to Purchaser.

5.11 Motors installation

Asynchronous LV motors of the usual design by ABB or Siemens have 4-6 holes for anchoring to the frame. They have 1 pair of anchor holes on the foot closer to the shaft at the L2 bearing. On the foot closer to the fan at the L1 bearing, they have 1 or 2 pairs in the case of extended feet. Motors without extended foot have hole spacing 'B' and motors with extended foot have hole spacing 'BB'. We require primarily anchoring motors to dimension "B".

Note: pre-drilling both dimensions is also an option.



6 LOCAL SWITCHES

According to the process requirements, some process motors shall be provided with local switches for jog or normal starting.

7 SAFETY SWITCHES

The main circuit of each 690 V and 400 V motor shall have a lockable safety switch installed next to the motor. The safety switch shall be located so that it does not hinder the maintenance of the equipment and it is clearly visible and recognisable to the applicable motor. The cabling for the safety switch shall mainly be performed from below.

The safety switches are equipped with auxiliary contacts, which shall be connected to the control system for position indication.

The Supplier shall, reserve the necessary space next to the motor for safety switch.

If VFD motor, safety switch has to be EMC-type with an EMC cable gland.

The safety switches are not normally included in the machine delivery, but the machine supplier has to reserve space for the safety switch next to the motor.

8 MCC'S

8.1 General

Motor starters will be equipped with intelligent motor controllers, which are controlled via Profinet, Profibus DP /Profibus PA

in the green field projects. In the brown field projects the existing communication protocol will be used. The communication protocol to be decide by Purchaser in each project.

Starters for special machinery (e.g. roll wrapping, conveyor, cranes, hoists, etc.) shall be included in the machine delivery. Starters shall be delivered ready assembled and wired in cabinets. The location of starter cabinets will be agreed with the Purchaser case by case.

Crane drives and other frequent start-up drives have to be dimensioned in accordance with the IEC category AC4.

Contactors loads must not exceed 75 % of its rated value.

In addition, contactors and motor starters have to be dimensioned so that it is possible to upgrade the motor with the next higher power rating. The minimum accepted motor contactor rating is 20 A.

8.2 Dimensioning Data

690 V MCC's		
Rated insulation voltage	V	1 000
Rated operational voltage	V	690
Rated Frequency	Hz	50
System neutral		TN-S without neutral

400 V Main board		
Rated insulation voltage	V	1 000
Rated operational voltage	V	400
Rated Frequency	Hz	50
System neutral		TN-S

9 VARIABLE SPEED SINGLE DRIVES

The procurement of the variable speed drives will be agreed upon case by case with the Purchaser.

The supplier has to specify all frequency converter drives to be included in the Purchaser's scope of supply. The specification sheet for variable speed single drives is in Appendix III.

The supplier has to include specification for the power supply, control, interlocks and dimensions of the cubicles concerning frequency converter drives included in the delivery. They must be controllable via Profinet, Profibus DP /Profibus PA in the green field projects. In the brown field projects the existing communication protocol will be used. The communication protocol to be decide by Purchaser in each project.

The Purchaser reserves the right to select the manufacturer for the variable speed single drives.

The frequency converters shall feed AC induction motors of the squirrel cage type, and will be digitally controlled, of the Pulse Width Modulation (PWM) type with flux vector control, or Direct Torque Control (DTC), or equivalent. Unless specifically requested, the motors will not have pulse-encoder feedback or equivalent.

Rectifiers are generally 6-pulse type. For very high power frequency controllers other solutions may be discussed.

A thermistor function for each converter-controlled motor > frame size IEC132 shall be included. A thermistor connected to the frequency converter.

The VSDs shall be freestanding (“stand alone”), wall mounted or alternately integrated in the MCC. Direction of power cabling (or busbars) and fixing shall be agreed during design phase. The degree of protection by enclosure of frequency converter cabinets shall be at least IP21 (IEC). Cabinets shall be installed in ventilated electrical room.

To avoid voltage raise in the motor terminals the frequency converters shall be provided with necessary common mode, du/dt-filters, sine-filters etc. The Supplier shall specify and deliver equipment when filters are necessary.

The VSDs shall be provided with a local control panel, located in the door of cabinet or in the switchgear door, including all necessary cables and accessories, with which the parameters, alarms, actual values of drive can be read and modified. In addition, applicable PC software(s) is included to the delivery.

The VSDs shall be provided with all necessary electrical protective functions for reliable and safe operation of drives.

EMC shielded cables should be used for VSD used motors.

VSD to be selected so that it is possible to upgrade the motor with the next higher power rating.

VSD protection degree against aggressive media must be selected in accordance with the quality of the electrical room air and the requirements of EN 60721-3-3 classification, or ISA S71.04-2013 standard.

10 STEP-DOWN TRANSFORMERS

The use of step down transformers shall be avoided and the use shall always be agreed with the purchaser.

10,5 kV, 6 kV or 690 V $\pm 2 \times 2.5 \%$ / 400 V dry transformers will be used to feed possible 400 V and 230 V process loads. Connection group shall be Dyn5 or Dyn11 (Alternative must be accepted by Purchaser) Primary and secondary windings shall be galvanically isolated. 400 V system shall be TN-S.

Transformers shall have 20 % reserve capacity for future extensions.

Enclosure class shall be IP21 in electrical rooms and IP54 in process areas.

Transformers shall be equipped with earthed screen between HV and LV windings.

Transformer shall be equipped with two temperature switches with PT100 sensors. Alarm switch shall be set to 130°C and trip switch to 155°C.

11 CONTROL AND MONITORING EQUIPMENT

11.1 General

The machinery and processes will be controlled from centralized control room. Local operator panels shall be avoided and be used only if required by the controlled machinery or safety.

First choice should be the use of identical DCS system for the machine controls as used for the plant control and monitoring. If this is not possible the Supplier shall propose alternative solution.

The control system shall be so designed that the effect of a failure is limited to the faulty circuit only and that the cause of the failure can be easily located.

Separate circuits have to be used for the following:

- Motor control circuits
- Alarm and indication circuits
- Solenoid valve circuits

11.2 Communication and Interfaces

All automation equipment, which are serving the same process area such as, CPU, process stations, I/O stations etc. have to be equipped with traffic monitor at both ends of the connection. If the communication stops at either end the unit shall switch itself to safe state i.e. I/O's to zero state and analogue outputs to safe state. Both stations should have and show watchdog signals as applicable for the communication method.

11.3 Control System

The system shall include all needed equipment, I/O-connections, system and application software, configuring/programming tools and system cables. The system shall be supplied in a fully operable condition, installed, tested and commissioned to meet Purchaser's requirements. Mondi OT security policy shall be followed for Network communication and segmentation & routing.

The implementation of the HMI (Human Machine Interface) shall be agreed upon separately with the Purchaser.

The process to be controlled shall be divided functionally into process parts. Each process part shall have its own controllers (process stations) and process interfacing units with cabinets/boxes.

In the green field projects there are three alternatives to connect field devices, instruments and control actuators to the control system.

- Traditional hardwired signals from field or MCCs to system I/O modules in rack and electrical rooms
- Distributed I/O in the field boxes or in MCC rooms
- Profibus PA, Profibus DP and Profinet for instrumentation and device bus for motor controls.

In the brown field projects the existing communication protocol will be used.

The communication protocol to be decided by Purchaser in each project.

After the realization of the project the overall Profinet measurement shall be performed by erection company to prove the parameters.

For Profinet and Profibus the calculation of the network utilization shall be done during the engineering phase of the project. All devices on the network the delivery shall be considered into calculation.

A Profinet analyzer device shall be part of the delivery for Profinet solutions for monitoring of the health-check.

Discrete inputs and outputs shall be galvanically isolated and powered by the system.

The system shall monitor the condition of the field equipment connections and indicate faults.

Field mounted automation equipment, such as distributed I/O modules, shall be designed to be applied in Class G3 corrosive environment, as defined by ANSI/ISA 71.04-2013, with the temperature operating range of 0 °C to +70 °C.

The following items specify the scope of each part:

- Installed I/O with 20 % spare for each I/O type
- Necessary field connections with 20 % spare
- Cabinets/boxes shall have 30 % free space for connections
- Necessary program memory with 50 % free space
- The load of each processor shall not exceed 60 % from the capacity informed by manufacturer
- Necessary licences (operation system, maintenance, configuration, tuning / diagnostic)
- Number based licences shall have 20 % spare tags or items
- Networks needed between control system parts and other control systems
- Networks shall be capable of transmitting all the data in any circumstance, providing 30 % expandability
- Field and I/O busses shall have 20 % spare capacity
- Necessary operating and reporting devices
- Alarms and event handling
- Diagnostic systems for easy and rapid failure detection archiving of process and system alarm messages
- Necessary maintenance and configuration devices
- Audit trail for operator actions (30 days)
- Audit trail for configuration changes
- Spare parts

The system shall have the above mentioned reserve spaces and expansion capability when handed over to the Purchaser.

Upgrade (patches, new versions), Backup & restore procedures to be discussed and agreed.

11.4 Instructions for SIL Specification and Delivery Limits of SRS

11.4.1 General

Risk evaluation including hazard and risk analysis and also evaluation of risk determination shall be made for the delivery. Different dangerous situations, consequences and decisions of risk tolerability shall be included in the evaluation of risk determination.

Hazard and risk analysis is divided into two different processes. The first phase concentrates on finding unknown hazards and the second phase on evaluations of identified risks.

According to the hazard and risk analysis, needed safety integrity level (SIL) shall be specified for each safety function. Specification of safety integrity level shall be made according to the standard IEC 61511 (Functional safety - Safety instrumented systems for the process industry sector).

The Supplier is responsible of the hazard and risk analysis. Purchaser shall be invited to take part on the hazard and risk analysis work.

11.4.2 Phase 1

Hazard evaluation report shall be made for the plant/equipment/device. For that a commonly used generally approved hazard analysing method shall be used.

11.4.3 Phase 2 (SIL)

Using the report from Phase 1, methods to reduce risks connected to all identified hazards shall be evaluated. Based on that, safety integral levels (SIL) for SIS are specified.

Actions to reduce risks using SRS systems (Safety Related Systems) including break discs, safety valves, SIS (Safety Instrumented system), etc. shall be specified in the evaluation.

The risk evaluation work shall concentrate primarily on human risks and major environmental impacts and secondarily on material damages and production losses.

11.5 Control Panels, Desks and Boxes

Conventional panels, desks and boxes can be used for local controls, if necessary, but they are not located in the central control rooms.

Profibus PA, Profibus DP, Profinet or Ethernet TCP/IP connected touch screen type (IP 65) local control panels are preferred.

Construction and protection of the panels, desks and boxes shall be adequate for the ambient conditions. Project instructions and standards shall be followed especially when defining the material and type of enclosure, e.g. enclosures located in harsh environment such as drying machine wet end which shall be type double box and made of material according to the EN 1.4401.

Field mounted control boxes and panels have to be equipped with air purge and/or with see through hinged cover.

The equipment has to be well located and easily accessible for maintenance purposes.

Internal connections have to be made by tinned min. 1.5 mm² (signals 0.5 or 0.75 mm²) multi stranded copper conductors with spring type connectors. Special conductors and wiring can be used for special purposes.

All signals shall use two terminals; no common signal shall be used in order to reduce wiring quantity.

All wiring from instruments and outgoing cables has to be connected directly to the terminal blocks. Different voltage levels have to be separated into their own wiring ducts and connected to separate terminal blocks groups.

EMC-glands shall be used for EMC shielded cables.

Fixing rails (C-bars) and gland plates have to be provided for the installation of external cables.

About 20 % of spare space has to be provided for future expansions.

About 10 % of spare terminal blocks have to be included.

The equipment shall have the above mentioned reserve space and expansion capability after start-up when handed over to the Purchaser (not before start-up).

11.6 Automation Cabinets

The control equipment related to the automation cabinet comprising of CPUs, programmable logic controllers, fuses, circuit breakers, contactors, relays, control and amplifier units, etc. shall be installed in the automation cabinets or agreed with the Purchaser according to local standard.

The cabinets have to be equipped with fixed lighting fitting, earthed socket outlet and with lockable main control switch.

The cabinet shall be equipped with an air filter. Adequate cooling or heating system depending of ambience shall be arranged.

Fuses, circuit breakers, neutral and earthing rails have to be arranged so that the insulation tests can be carried out in a normal way.

The equipment for main circuits and control circuits shall be easily discernible from each other.

When cabinet doors are open all parts, which could be energized, shall be fully protected to prevent contact by personnel.

The cabinets shall be installed in electrical or rack rooms.

Project standards, Mill standard and instructions at Item 11.5 for control panels and desks shall be followed.

11.7 Signal Lights

Signal light (preferable LED-type pilot lights) fittings have to be either round or rectangular, and opened on the top, and which can be exchanged without opening the lid of the box or desk. All panels with pilot lights shall be equipped with lamp test.

Push buttons and switches:

Red mushroom head	Emergency stop
Red	Stop or Off
Yellow	Override
Green	Start or On
Blue	Auxiliary functions
Black	Aux. functions not significant
White	Aux. functions not significant

Pilot lights:

Red	Abnormal condition
Yellow	Readiness / Warning
Green	In operation
Blue	Auxiliary functions
White	Control circuit supplied with voltage

Deviations thereto (e.g. Syktyvkar) only upon agreement with Purchaser.

11.8 Control and Monitoring Equipment

All control and monitoring equipment have to comply with the Purchaser's equipment standard. Deviations to be agreed upon separately.

11.9 Machinery start-up alarms

All equipment with exposed moving parts such as conveyors etc. that can be started remotely shall be equipped with visual and audible start warning alarms.

12 FIELD EQUIPMENT

12.1 General

The purchaser reserves the right to select the manufacturer for the field equipment. Recommend manufacturers are shown in standard MEIA0002.

Field equipment shall be located in such a way that easy access and maintenance is possible.

Speed guards will be used with belt drives, conveyors and belt driven rotating equipment (fans etc.). The speed guards shall be mechanically mounted, cabled and connected to terminal boxes.

Measurements based on mechanical slide wires shall not be used.

All transmitters, positioners and sensors shall have certificates of validation.

12.2 Sensors

Field devices, such as limit switches, photocells and similar equipment, have to be installed so that their maintenance and adjusting can be carried out while the equipment is in operation. The devices have to be dust and waterproof, and so constructed and installed that vibration, temperature and dust in the equipment does not damage the devices or cause disturbances in their function.

Limit switches and corresponding instruments, which are under heavy usage, have to be easily replaceable. Cable connection shall be done in separate connection box with soldering type of connection.

Proximity type (24 VDC, 2-wire) switches shall be used as limit switches. If mechanical switches are used the contacts shall be gold plated.

The delivery, installation and tuning of field instruments shall be included in the machine delivery.

12.3 Transmitters and Positioners

Transmitters and positioners shall communicate with the control system using one of three alternatives:

- Traditional hardwired signals from field or MCCs to system I/O modules in rack and electrical rooms. In addition to the mA signal the field devices shall be equipped digital communication with HART.
- Distributed I/O in the field boxes or in MCC rooms
- Profibus PA, Profibus DP and Profinet for instrumentation and device bus for motor controls

Transmitters and positioners shall embedded diagnostic technology like FDT/DTM (Field Device Tool/Device Type Manager) or EDDL (Electronic Device Description) or DDL (Data Definition Language).

Equipment with pneumatic metering signals is not accepted for the new installations.

12.4 Pressure Vessels

In accordance with Piping Standards, material certificates have to be presented for components and equipment to be delivered to pressure vessels and A class piping which have to be registered. Pipes for steam, dangerous or inflammable fluids or gases belong to the A class piping.

12.5 Direct Mounting and Maintenance Valves

Direct mounting and maintenance valves, which are an integral part of the equipment, have to be included in the delivery.

Solutions where the sensor or transmitter can reliably and safely be removed for maintenance or replacement will be preferred in the following applications:

- Level transmitters in storage tanks
- Sensors or transmitters which require frequent cleaning, checking or replacement

Three-valve or five-valve (for steam) manifolds are used in pressure differential transmitters.

Solenoid valves (pilot type) and corresponding instruments to be installed in the same group have to be equipped with an individual isolation valve per instrument. It has to be possible to replace an individual instrument without disturbing the operation of the other instruments.

All maintenance valves, which are used for isolation, shall be capable of being locked in the isolated position by means of the mill standard safety padlock.

12.6 Process Connections

Temperature sensors, flanged pressure and level transmitters have to have connections in accordance with DIN Standards.

Pressure and differential pressure transmitters for the clean process media shall have connections of R1/2”.

Condensate pots shall be used in steam applications for flow, level and pressure.

If the connection of equipment deviates from the normal threaded or flanged coupling, the connection has to be included in the machine delivery. The material of the connection has to be suitable for the connection point and process media.

The pressure class of the equipment connection on the flow pipes shall be the same as that of the piping.

12.7 Remote-Operated Control and On-Off Valves

The primary valve selection criteria shall be reliability, low maintenance costs and good application experiences in pulp and paper industry.

Valve materials shall be selected according to general valve recommendations.

The principles for selecting valves shall be:

- Mainly ball, segment ball and butterfly valves with metal seats shall be used.
- Globe valves shall be used only in steam and condensate, if necessary.
- Ball valves with reduced bore can be used up to DN 300.
- The smallest acceptable size for butterfly valves is DN 80.
- Instead of three-way or four-way valves, two or three standard valves shall be used.

All control and on-off valves shall be:

- Full ball flanged all sizes

- | | | |
|---------------|------------------|----------------|
| – Sector ball | wafer for sizes | ≤ 250 mm, |
| | flanged for size | > 250 mm |
| – Butterfly | wafer for | ≥ 80 mm |
| – Globe | flanged | |
| – Gate | wafer | > 250 mm |

Deviations thereto only upon agreement with Purchaser

For dangerous process flow media only flanged connection shall be used.

Flanges shall be selected according to Purchaser's piping standard. Threaded connection shall not be used.

Actuators shall normally be double acting equipped with valve position indication. Spring-to-close or spring-to-open actuators shall be used in special applications and shall be decided case by case.

Actuators equipped with electric motors can be used in special applications (e.g. steam shut-off).

Control valves shall be equipped with pneumatic actuators and digital electro pneumatic positioners. Additionally positioners shall support either Hart or Profibus.

Remote-operated on-off valves shall be equipped with limit switches for open/close positions. The limit switches shall be proximity type (24 VDC, 2-wire). The actuators shall be pneumatic.

Remote operated on-off valves shall be controlled by 5/2-way solenoid valves. Solenoid valves shall be installed in field junction boxes and connected by traditional hardwire or via Profibus PA, Profibus DP and Profinet in green field projects. In the brown field projects the existing communication protocol will be used. The communication protocol to be decide by Purchaser in each project.

It is allowed to install solenoid valves on the on-off valve itself after approval by the Purchaser under appropriate conditions.

Each control valve shall be supplied with a dimensioning sheet indicating installed flow characteristics and installed gain.

All remote-operated valves, which are used for isolation, shall be capable of being locked in the isolated position by means of the mill standard safety padlock.

12.8 Emergency Stop

Necessary emergency stop and safety systems shall be included in the delivery. Emergency stops shall be placed at dangerous operation areas. The switches have to be provided with necessary number of contacts: minimum one for emergency stop control and the other for control system indication.

EN approved emergency stop circuits and relays have to be included.

12.9 Material Certificate

In accordance with EN 10204 Standard, material certificates shall be presented for components and equipment for pressure vessels and class A piping, which shall be registered. Pipes for steam, dangerous or flammable fluids or gases are class A piping.

13 CABLING

The Purchaser's cable standard and selection table shall be followed, see cable standard MEIA0005.

The heavy duty cable trays or ladder racks are not normally included in the machine delivery.

When the cables are mounted directly on the machinery, pipe bridges or conveyor bridges, the supporting structure for the cable trays have to be included in the machine delivery.

The material for cable trays and ladder racks shall be either stainless steel, hot dip galvanized steel, aluminium or acid-proof steel according to the process area specification.

Where cables leave ladders outside electrical rooms, they shall be mechanically supported/protected for example by using L- or U- shape acid-proof steel or as secondary solution with hot dip galvanized steel or aluminium protection.

Deviating material selection only upon agreement with Purchaser.

14 INSTALLATION

14.1 Installation delivery limits

The installation material, installation supervision, calibration, testing and start-up of the equipment described above shall be included in the machine delivery. Installation is included in pre-manufactured machine parts (e.g. wire section, press section, dryer section, etc.).

The recommended locations for cable trays to be supplied by the Purchaser shall be marked on the equipment arrangement drawings.

For the pneumatic supply air piping material from the Purchaser's air header to the machinery or equipment the Purchaser will supply the connection at the header including the isolation valve at the delivery limit.

All Purchaser specified process connections with isolation valves for the delivered machinery, equipment or piping shall be included in the machine delivery.

Installation of Purchaser supplied instruments and remote controlled valves into Supplier supplied piping or machinery shall be included in the machine delivery.

The Supplier shall be responsible for unloading and transporting his equipment to final installation site. The Supplier shall install the equipment in system rooms, control rooms and in process areas in locations given by Purchaser.

The Supplier shall provide adequate manpower to carry out installation supervision of the part of his equipment installed by others. The power-up of the system is the responsibility of the Supplier.

Installation shall be done according to the Electrical Installation Standard MEIA0008 and the Instrument and Automation Installation Standard MEIA0007.

14.2 Installation material

The Project cable standard and selection table shall be followed.

The material for cable trays (and supports) and ladder racks shall be hot dip galvanized, acid-proof steel (EN 1.4401) or aluminium according to the process area specification. Acid-proof steel (EN 1.4401), shall be used in paper machine wet end and other areas, where aggressive chemicals are present. The material of the cable tray must be accepted by purchaser.

The material for protection tubes in process areas shall be of acid-proof steel (EN 1.4401), and in the remaining areas stainless steel (EN 1.4301), aluminium or acid-proof steel. The tubes shall be fixed with acid-proof steel (EN 1.4401), heavy duty pipe clamps.

15 NUMBERING AND MARKING

15.1 Item Designation

All electrical, instrument and automation equipment, wiring and cabling shall be given designations and marked in accordance with the Mill or project standard. These item designations have to be marked also on the drawings and documents.

The Purchaser provides the necessary information and number series for the item designations of control desks, boxes, cabinets, cables, etc.

15.2 Marking and Name Plates

All devices must be equipped with position numbers according to Project standards already when delivered.

The delivery shall include all necessary nameplates for the field instruments, motors, panels, desks, boxes and cables. The Purchaser approves the nameplate texts.

The quality and text of the nameplates have to comply with the project marking instructions.

All electrical motors shall be equipped with the Purchaser's consecutive number ("identity number"). The number plates shall comply with the Project nameplate

standard, and shall be located on the right side of the frame seen from the fan end of the motor, on a fixed part of the motor frame (i.e. not on removable component).

16 DOCUMENTATION

16.1 General

Any technical documentation and drawings should be written in local language, unless otherwise agreed with the purchaser.

Preliminary information is needed for basic engineering and enquiries and binding information for purchasing and detail engineering. As-built documents are needed for operation, maintenance and technical archive. As-built documents are supplied after start-up and correspond to the current status. As-built documents has to be hand over in editable format, example in dwg-format.

The machine delivery shall include all specifications and data necessary for engineering and implementation of electrification, instrumentation and automation.

Where the supplier is responsible for engineering of the plant, the machine delivery shall include all instructions and drawings necessary for the installation, start-up and operation of the plant.

Faults have to be often repaired by a maintenance crew who is not familiar with the specific device. Therefor fault diagnostics and maintenance and operation instructions and other documentation shall be easy to follow, logical, complete and written in local language.

System documentation can be in English (if translated to local language, the original English one shall be available), all information to operators and / or used in daily services shall be in local language and English.

All drawings shall be specific to the installation (not general standard drawings) and shall show item designations in accordance with the Project instructions.

All technical data, instructions, manuals and documentation shall be delivered in agreed number of copies, arranged in organized binders, originals in electronic form and entered into the Purchaser's database in accordance with the Purchaser's instructions.

The Supplier is responsible to update documents also during warranty period.

16.2 Drawings

Drawings should be provided with Purchaser's legend, filled in according to Purchaser's instructions. Motor circuit and wiring diagrams and instrument connection and loop diagrams shall be made on Project standard formats. All electrical and instrument maintenance documentation (e.g. loop diagrams) must be loop specific.

All drawings and documents shall comply with the Project drawing and technical document standards.

All drawings shall be prepared taking into account electronic transfer in accordance with the Project instructions.

Drawing sizes A4 and A3 are preferred. Equipment arrangement drawings or similar are an exception.

The final documentation shall be delivered according to the Purchaser's instructions.

Necessary documents, in general, are:

- Lists of drawings and documents
- Loop and circuit lists
- Motor and equipment lists
- Instrument and component lists
- One-line diagrams
- Special starters-rack, panel and box lists
- Field equipment lists
- Interlocking, sequence and logic diagrams
- Connection data (voltage, average and peak power, etc.)
- General description of the equipment
- Technical data, data sheets of electronic devices, testing, checking and approval certificates required by authorities
- Loop, circuit and network diagrams
- Hydraulic diagrams
- Connection diagrams
- Cable and pipe lists
- Specification of programmable logic controllers
- Program descriptions and programs of programmable logic controllers (programs with comments)
- Specifications of bus and i/o interfaces of programmable logic controllers to the other system
- Signal and I/O-lists
- Design drawings and documents for control system hardware including overall control system structure and hardware specifications
- Design and drawings for cabling between different systems and cabinets including details of cable termination
- Design and drawings for control system internal power distribution and earthing
- Documentation of graphic displays (acceptance by Purchaser)
- Detailed description of each object of the process (part process, pump, agitator, screen, refiner, individual electrical and control loop etc.), group starts and sequences shall be given in HTML format. The descriptions shall be used for application programming and as instructions for operators. The description shall include detailed description of the functionality, operation and interlocking of each object during normal operation, start-up and shut-down. In complicated cases interlocking, sequence or logic diagrams shall be provided in addition.
- Certified dimensional drawings for all equipment included in delivery
- Layout drawings of field equipment, cable trays, motors, devices, desks and boxes
- Layout drawings with dimensions of panels, desks, control and auxiliary boxes including component specifications
- Wiring drawings of cabinets and desks

- Foundation and floor opening requirement drawings
- Name plate lists
- Alarm, calibration etc. lists with complete process, measuring range, limit, etc. data
- Transmitter calibration and actuator setting records
- Operation instructions
- Installation instructions
- Preventive maintenance instructions
- Maintenance instructions
- Installation and troubleshooting instructions
- Spare part recommendations
- Spare part lists
- CE documents according to Mill safety standards
- SRS and ATEX documents according to Purchases safety standards
- Earthing layouts
- Earthing connection diagrams

16.3 Documentation for Equipment and Process Control Systems Procured by the Purchaser

The delivery shall include minimum the following documents:

- Process and equipment description
- Flow sheet, if the Supplier is responsible for the process design
- Detailed description of each object of the process (part process, pump, agitator, screen, refiner, individual electrical and control loop etc.), group starts and sequences shall be given in HTML format. The descriptions shall be used for application programming and as instructions for operators. The description shall include detailed description of the functionality, operation and interlocking of each object during normal operation, start-up and shut-down. In complicated cases interlocking, sequence or logic diagrams shall be provided in addition.
- Proposal for the graphic displays and reports of the control system
- Motor lists and basic data for electrification
- Basic data for instrumentation including the description of control functions and operation, loop lists with instrument recommendations, process information, calibration ranges and scales
- Description of special requirements such as interlocking with hardwiring, redundancy, or other special requirements etc.

17 START-UP

17.1 General

The supplier has complete responsibility for testing and start-up of electrical, ICT and automation equipment and components included in his delivery. Functional systems shall be tested prior to delivery together with the Purchaser.

The Purchaser will be responsible for testing, commissioning, and start-up of the equipment outside the Supplier's scope of supply but related to his delivery. The Supplier will, however, be required to participate in the testing, commissioning and start-up for his delivery.

17.2 Testing

The Supplier shall be completely responsible for testing of all components and systems included in the delivery and for the connections to other systems. The Supplier shall deliver testing instructions to Purchaser before testing and reports after testing.

Prior to start-up the Supplier shall check, test and verify that all electrical, instrument, ICT and automation equipment included in his delivery function and operate as designed and that equipment and machines are ready for the start-up of the process.

The supplier shall prepare a test report including set ranges, parameter values etc.

17.3 Start-up

The Supplier shall participate in the start-up according to the Purchaser's schedule.

During the commissioning and start-up and tuning period the Supplier shall be responsible for the proper functioning and operation of the electrical and automation equipment included in his delivery. The Supplier shall assist to solve the problems due to the Supplier's incomplete or faulty specifications in linking the Purchaser's scope of supply to form a complete and fully operative combination with the Supplier's equipment.

17.4 Responsibilities after the Start-up

The Supplier shall revise and update his documentation concerning the electrical, ICT and automation equipment included in his delivery as regards the changes made during the check-out, commissioning, start-up and test runs. The Supplier shall ensure that the client has a set of hand marked as-built documents after the start-up before the final documentation is delivered.

Delivered systems, programmable equipment and smart instruments shall have all required system software and licenses needed for software modification, system maintenance, diagnostics and troubleshooting. Backups shall be included.

18 TRAINING

The Supplier shall include sufficient training for the Purchaser's operation and maintenance personnel within his scope of the delivery. The Purchaser will specify the participating team and accept the training scope.

Training for the EIA special tools, like programming environment, maintenance and trouble shooting and diagnostic applications etc. shall be included.

The training shall be carried out according to Purchaser's schedule and completed during the start-up and commissioning with the actual supplied equipment.