INTER PLANT STANDARD – STEEL INDUSTRY		
IPSS	**PARTICULAR REQUIREMENTS OF ROLLING MILL VVVF DRIVES**	**IPSS: 1-10-043-15**
	CORRESPONDING IS DOES NOT EXIST	

0. FOREWORD

0.1 This Inter Plant Standard has been prepared by the Standards Committee on Electrical Components and Equipment, IPSS 1:10 with the active participation of the representatives of the steel plants, major consulting organizations and established manufacturers of rolling mill VVVF drives and was adopted in September 2015.

0.2 Inter Plant Standards for steel industry primarily aim at achieving rationalization and unification of parts and assemblies used in steel plant equipment and accessories, and provide guidance in indenting stores or equipment (or while placing orders for additional requirements) by individual steel plants. For exercising effective control on inventories, it is advisable to select a fewer number of sizes/types from those mentioned in this standard, for the purpose of company standards of individual steel plants. It is not desirable to make deviations in technical requirements.

1. SCOPE

1.1 This Interplant standard covers the particular requirements of rolling mill VVVF drives used in steel industry. This document shall be read in conjunction with IPSS :1-10-035-15(F) and shall be applicable for rolling mill drives as additional & specific requirements. This specification covers all mill drives excluding :

i) Main Drives
ii) Roller table drives.

These drives shall be further categorized as follows:

1. Reversible heavy duty drive.
2. Non reversible heavy duty drive.
3. Light duty low capacity drives.

2.0 SPECIFIC DESIGN PARTICULARS:

- IGBT based with sine coded PWM control.
- 4 quadrant, regenerative Active Front End design with harmonic control defined by IEEE 519-1992(G5/4), excepting for Cat 3 as mentioned above.
- EMC – to fulfil all immunity requirements and comply to emission EMC level 'L' : EN 61800-3 Cat C3.
- Safety- IEC-61800-5
- Communication with basic automation system on com-bus.

2.1 Incoming supply:

- ACB/MCCB with 50 kA rating (Positive isolation feature).
- Isolation transformer / line reactor for harmonic & noise suppression. Isolation transformer K factor <4.
- ac line surge suppressor network.
- Line contactor with bypass arrangement in case of VFD failure.

2.2 Capacity rating:

- Drive shall be rated for 150% of rated motor current fed from the drive, with hot/cold standby provision as specified by indentor.

2.3 Controller:

- V/F software configurable, multi motor.
- Adjustable PWM carrier frequency for 3-15 kHz.
- Multiple programmable stop modes including –Ramp, Coast, dc-brake, Ramp to hold & S-curve.
- Multiple acceleration & deceleration rates.
- dc bus regulation to prevent over voltage trips due to regenerative condition for Cat 1 Reversible heavy duty drives.
- On board application programme developed in IEC 61131-3 compliant language.

- Provision of storing & down loading configuration.
- IGBT initialization testing by control section on each power up & run command.

2.4 Output :

- Voltage-from 0 to rated motor voltage.
- Variation: +/-0.1% with input variation of +10% ,-15%.
- Steady state regulation of +/-0.25% against 100 to 200% load disturbance & +6%,-6% input supply frequency variation.(Input supply may contain line notching & upto 10% harmonic distortion)
- Frequency-Min 6 step set points, resolution: 0.01Hz.
- Reflected Wave- Max 3.15 times bus voltage or 1600 V whichever is less, upto cable length of 200 m.
- Speed Control Accuracy: +/-0.02%.

2.5 Control Functions:

2.5.1 **Ramp rate**- linear acceleration & deceleration adjustable independently as required from 0 to 1600 sec with remote accessability of Accel/Decel setting through digital inputs.

2.5.2 **Current Limit**- This shall be load dependant & programmable from 0.1 amp to 150 % of drive rated amps. Current limit shall be active for all drive states, accelerating, constant speed & decelerating.

2.5.3 **Ride through**- control logic should be capable of 'ride through' on power outage, of at least 0.5 seconds in duration & inverter section should be shut off after 18% drop in bus voltage to conserve power for the drive logic.

2.5.4 **Over voltage stall** - To prevent faults caused by regeneration during deceleration, over voltage stall shall extend deceleration time when bus level reaches a user configurable level.

2.5.5 **Jog** - Jog frequency shall be configured for forward/reverse direction for any frequency between 0 to 10 Hz, from any appropriately configured input terminal.

2.5.6 Jog stop method shall be configurable to coast, controlled deceleration or dc injection.

2.5.7 **Diagnostic Check**-

Microcontroller logic circuit diagnostic shall be performed on application of power to prove functionality and viability of micro controller logic circuits.

Memory Cyclic Redundancy Check (CRC) to be performed on application of power to prove integrity of EEPROM & UVPROM memory.

2.6 Upgradeability of CPU & Firmware-

- Microcontroller logic circuits shall be of latest design CPU with adjustable frequency drive specific circuitry & firmware and upgradeable features.

2.7 Hot /Cold Standby Provision:

- Provision of changeover & communication, data/programme transfer shall be made available in the panel as required for Hot/cold standby facility, by the indentor.

- Communication module shall have the facility (selectable) to act like Master or slave.

2.8 Dynamic Braking:

- Drive shall have internal in-built IGBT for use as dynamic braking chopper. This shall have capacity to handle 100% regeneration power from output continuously. This shall be applicable for all category of drives, unless otherwise specified.

2.9 Input/Output:

- Hard wired I/O should be provided via separate I/O card.
- Standard I/O comprising both digital & analog I/O shall be available in115/240V ac for digital I/O-one & 24V ac/dc for digital I/O-one.
- Analog I/O differentially isolated +/-10 V (bipolar)/20mA analog input.
- Digital output: Relay O/P- 04 nos min (240 V ac/24Vdc ,2A rating)
- Programmable analog input: +/- 0-10V & 0/4-20mA.
- Programmable analog output: 0/4-20mA.
- Logic inputs: 04 nos, programmable 24V, Compatible with level 1 PLC (0 =<5V, 1= >11V) , Configurable on L1 or for PTC probe (10V/16 V).
- Encoder Interface card with differential, open collector & push pull output.

2.10 Annunciation:

- All protection/fault shall be annunciated in key pad of the drive/HMI.

- Following additional features shall be provided.
  a. Transformer fault.
  b. Loss of frequency command.
  c. Storage of 16 previous faults in memory in FIFO sequence.

- In addition to annunciation in key pad, a separate annunciation window shall be provided in front door of VFD panel.

2.11 Key Pad:

- Menu navigation
- On line help
- Quick start
- Instrument failure
- File storage
- Monitoring output Voltage, Current, kW, Interlocks
- dc link Volts.

2.12 Metering & Signalling:

- Provision of Input/output voltage, current, frequency & kW meter in programmable digital display.
- LED indicators for presence of 1. Drive voltage, 2. dc voltage.

2.13 Protection:

- Microcontroller monitored thermal sensor on heat sinks for thermal protection.
- IGBTs shall have soft recovery free wheeling diodes to prevent IGBT failure when subjected to motor discharge spikes. This shall apply to DB circuit also.

2.14 Segregation & isolation:

- Between power & control (Input, Output & power supplies)
- Control cables with removable connectors & EMC screen clamping.
- Power cables with channel guides for segregation & satisfying EMC performance.

2.15 Heat Load Data:

- Drive Heat load data shall be provided by the supplier.