IONPURE®

TECHNICAL BULLETIN 2019-01c

Title Isolation Transformer Selection for DCR power controllers

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Scope This bulletin is an update of Service Bulletin IPSB-2017-02, and it incorporates the new DC voltage recommendations of Technical Bulletin IPTB-2018-02. It applies to Ionpure power controller models IP-DCR600V15A-R2 (W2T 827 122), and IP-DCR600V15A-M (W2T 827 123). Revision C corrects the kVA requirement for VNX30CDIT.

Purpose An isolation transformer is required upstream of the Digital Communication Rectifier (DCR) to provide electrical isolation between the AC input and the DC output, and to ensure that the CEDI module cathode is at zero volts. But the selection of the transformer voltage can affect the DCR's reliability, waveform and power factor (efficiency), as well as the CEDI module performance. This bulletin gives recommendations on transformer selection.

Design Considerations

Primary (input) AC voltage: can be single or three-phase, selected to match the power available at the site. **NOTE:** ***the three phase primary should be Delta, not Wye.***

Voltage Taps, Primary: Voltage taps in the primary are recommended by most transformer manufacturers, to ensure that the transformer provides the desired output voltage. A common tap arrangement is two 2.5% taps above and four 2.5% taps below nominal voltage. Transformers are shipped with the taps connected for nominal voltage. The installing electrician must change the taps if the actual supply voltage at the site differs from the nominal voltage rating.

Secondary (output) AC voltage: **Must be single-phase**. The voltage can be from 220 to 660 VAC but must be at least 1.1 times higher than the maximum DC voltage required by the CEDI module.

Voltage Taps, Secondary: ***voltage taps in the secondary are required to optimize the efficiency (power factor) and reliability of the DCR as well as the salt removal performance of the CEDI module.*** Suggested taps are given in column 4 of Table 1, below, and represent 33%, 67% and 100% of the maximum transformer secondary voltage. The maximum DC output voltage of the DCR will be about 90% of the selected tap (DCR input) voltage.

Number of Secondary Windings: The preferred configuration is a dedicated secondary winding for each DCR power controller. While a single secondary winding can feed multiple DCRs, this requires the installation of a diode on each DCR heatsink ground connection to prevent cross-unit interference through the ground. Contact Ionpure for instructions.

Frequency: 50 or 60 Hz.

Duty Cycle: 100%

Isolation transformer rating (KVA): This is determined by multiplying the (maximum DC voltage) by the (maximum DC current) and by the safety factor 1.5. See Table 1.

Temperature Rise and Insulation Class: Transformers with 130 or 150 °C temperature rise with an insulation class of 220 °C are commonly available. Transformers with lower temperature rise are more efficient and have longer service life, but are priced higher. Selection is left up to the user. IEC standards specify the maximum temperature rise of transformers in relation to the insulating material used.

Construction: Use open frame transformers with copper windings. Copper-wound transformers are usually more efficient and smaller than aluminum-wound units.

Thermal Switch: It is recommended to have a thermal switch embedded in the secondary winding to shut off the AC supply to the transformer if the temperature exceeds a set value, below the insulation class maximum temperature.

Table 1: Isolation Transformer Sizing for IONPURE CEDI Modules (single power controller)

Module Type (CEDI)	Maximum Required DC Volts	Maximum Required DC Amps	Input Voltage to DCR (VAC taps)	Minimum Transformer kVA Rating*
MX30	27	2.5	10 / 20 / 30	0.1
MX60	53	2.5	20 / 40 / 60	0.2
MX125	106	2.5	40/80/120	0.4
MX250	213	2.5	80 / 160 / 240	0.8
MX500	426	2.5	160 / 315 / 470	1.6
LX04 X&Z (-4)	27	6	10 / 20 / 30	0.3
LX10 X&Z (-4)	67	6	25 / 50 / 75	0.6
LX18 X& Z (-4)	120	6	45 / 90 / 135	1.1
LX24 X& Z (-4)	160	6	60 / 120 / 180	1.4
LX30 X& Z (-4)	200	6	75 / 145 / 220	1.8
LX45 X& Z (-4)	300	6	110 / 220 / 330	2.7
LX04HI (-3)	50	10	20 / 40 / 60	0.8
LX10HI (-3)	125	10	45 / 95 / 145	1.9
LX18HI (-3)	225	10	80 / 170 / 250	3.4
LX24HI (-3)	300	10	110 / 220 / 330	4.5
LX30HI (-3)	375	10	140 / 280 / 420	5.6
LX45HI (-3)	600	10	220 / 440 / 660	9.0
VNX 28EP (-2)	300	6.6	110 / 220 / 330	3.0
VNX 55E (-2)	300	13.2	110 / 220 / 330	6.0
VNX 55EP (-2)	300	13.2	110 / 220 / 330	6.0
VNX 55EX (-2)	300	13.2	110 / 220 / 330	6.0
VNX15CDIT (-2)	600	6.6	110 / 220 / 330	6.0
VNX30CDIT (-2)	600	13.2	110 / 220 / 330	12.0
VNX55HH (-2)	600	8 **	220 / 440 / 660	7.2
VNX-Max (-1)	600	7	220 / 440 / 660	6.3
VNX-Mini (-1)	480	6	160 / 320 / 480	4.3

*Based on secondary voltage taps given in column 4. In most cases, custom designed transformers will be required (e.g. secondary voltage taps and 660 VAC secondary are not standard). The primary windings must be wound for the available AC mains voltage.

**For 1.0-2.0 ppm hardness (as $CaCO_3$) in feed.

NOTE: Legacy Ionpure modules are not covered here. See IPSB-2017-02.