

## Piping and Cabling Manual

# JuicePump



TRI125-175-S (USA)

175 kW DC

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## 1 Overview

This document defines the cabling and piping of the JuicePump 175-S system. It serves as an aid to install the infrastructure required to put the JuicePump 175-S system into operation.

This document describes the minimum requirements.



### Important

Prior to installation of the piping and wiring, a professional review of local requirements **must** be performed to ensure that laws and regulations are adhered to. As a result, it may be required to deviate from the requirements of this documentation.

The manufacturer recommends the use of copper cables.

Ensure that any cables used, fit correctly.

## 2 Overview of conduits for JuicePump 175-S system

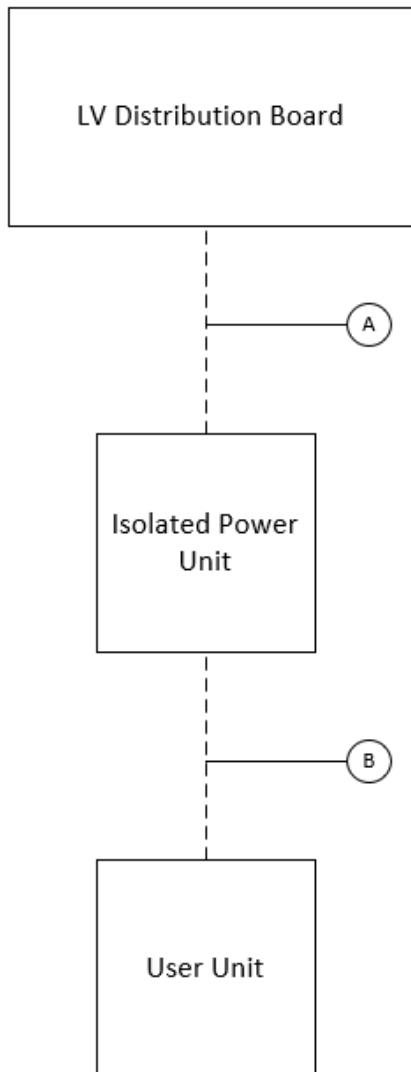


Figure 1: Bird's-eye view of the system with underground conduits.

### 3 Conduit requirements

Conduit	Diameter [mm]	From - To	Sub Conduit	Termination above ground [mm]		Quantity	Comments
				From side	To side		
A	125	Power unit – LV Distribution Board	-	Note 1.	Note 2.	1	
B	110	Power unit – User unit	1 x 25 1 x 32	Note 1.	50	1	

**Installation notes:**

1. Conduits to and from the power unit must end within the foundation cavity to allow ample length for cables to bend and align with the cable glands in the base of the power unit.
2. Required termination height at the LV distribution panel must be confirmed with the LV distribution panel supplier.

## 4 Cabling requirements



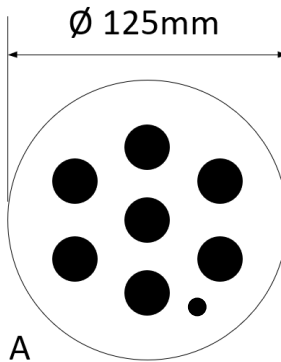
### Important

Cabling requirements are specified for USA, Canada, and Worldwide. Ensure that you use the correct cabling requirements for your location.

### 4.1 Conduit A – Worldwide 400V 50Hz



**Important:** This section is for all locations **except** USA and Canada.



All cables are double insulated and must conform with all relevant local regulations


1. Marking of AC power cables: “Lyz”, where:  
 y: Phase number  
 z: Cable number

For example: L21 (Phaseline 2, cable 1)

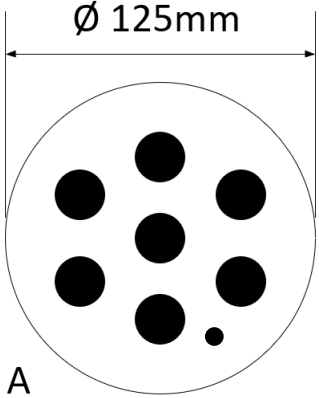
**Note:** The calculations in this table are based on site conditions as described in the Appendices. Ensure that you use the correct calculations for your site.

Cable#	Quantity	Description	Minimum recommended cable type	Marking	Termination above ground [mm]		Usage	Notes
					LV Distribution Board	Power Unit		
1	7	AC cable, 450/750V, min pairs of 70mm <sup>2</sup> , different colours for 3 phases and earth	Flexible Copper Conductor, SDI, X-90 Insulated, 70mm <sup>2</sup>	1)	TBD	350	3-phase plus earth	5.1 Reference specification for AC link – Worldwide 400VAC
2	1	AC Cable, 0.6 / 1kV, single core earth cable.	Flexible Copper Conductor, SDI, X-90 Insulated, 2.5mm <sup>2</sup>	2)	TBD	NA	IMI Earth Reference	Continues unbroken to User Unit

## 4.2 Conduit A – USA 480V 60Hz / Canada 480V 60Hz



**Important:** This section is for USA and Canada.



All cables are double insulated and must conform with all relevant local regulations


- Marking of AC power cables: “Lyz”, where:  
 y: Phase number  
 z: Cable number

For example: L21 (Phaseline 2, cable 1)

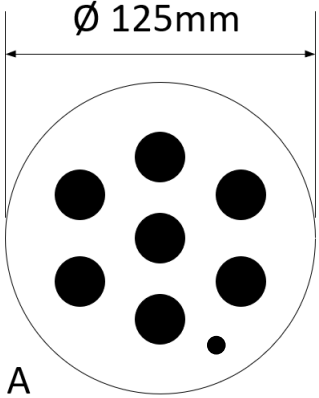
**Note:** The calculations in this table are based on site conditions as described in the Appendices. Ensure that you use the correct calculations for your site.

Cable#	Quantity	Description	Minimum recommended cable type	Marking	Termination above ground [mm]		Usage	Notes
					LV Distribution Board	Power Unit		
1	7	AC cable, 0.6/1kV, min pairs of 3/0AWG, different colours for 3 phases and earth	Flexible Copper Conductor, SDI, X-90 Insulated, 3/0AWG	1.	TBD	350	3-phase plus earth	5.2 Reference specification for AC link – USA / Canada 480VAC
2	1	AC Cable, 0.6 / 1kV, single core earth cable.	Flexible Copper Conductor, SDI, X-90 Insulated, 14 AWG	2)	TBD	950	IMI Earth Reference	-

### 4.3 Conduit A – Canada 600V 60Hz



**Important:** This section is for Canada **only**.



All cables are double insulated and must conform with all relevant local regulations

- Marking of AC power cables: “Lyz”, where:  
 y: Phase number  
 z: Cable number

For example: L21 (Phaseline 2, cable 1)

**Note:** The calculations in this table are based on site conditions as described in the Appendices. Ensure that you use the correct calculations for your site.

Cable#	Quantity	Description	Minimum recommended cable type	Marking	Termination above ground [mm]		Usage	Notes
					LV Distribution Board	Power Unit		
1	7	AC cable, 0.6/1kV, min pairs of 1/0AWG, different colours for 3 phases and earth	Flexible Copper Conductor, SDI, X-90 Insulated, 1/0AWG	1.	TBD	350	3-phase plus earth	5.3 Reference specification for AC link – Canada 600VAC
2	1	AC Cable, 0.6 / 1kV, single core earth cable.	Flexible Copper Conductor, SDI, X-90 Insulated, 14 AWG	2)	TBD	950	IMI Earth Reference	-

## 4.4 Conduit B – Worldwide

STOP
**Important:** This section is for all locations **except** USA and Canada.

All cables are double insulated and must conform with all relevant local regulations

**Note:** The calculations in this table are based on site conditions as described in the Appendices. Ensure that you use the correct calculations for your site.

Cable#	Quantity	Description	Minimum recommended cable type	Marking	Termination above ground [mm]		Usage	Notes
					User Unit	Power Unit		
1	2	DC Cable class X-90 (2 DC cables), min 70mm <sup>2</sup> , different colours for positive, negative and earth	Flexible Copper Conductor, SDI, V-90 Insulated, 70mm <sup>2</sup>	-	550	1800		5.4 Reference specification for DC link – Worldwide
2	1	1 earth conductor, min 35mm <sup>2</sup>	Flexible Copper Conductor, SDI, V-90 Insulated, 35mm <sup>2</sup>	-	250	450	Protective Earth	
3	1	Copper flex cable 2 cores, min 0.5mm <sup>2</sup>	Flexible Copper, V-70 insulated, 2 core 2x0.5mm <sup>2</sup>	-	450	950	Safety Loop	Sub conduit 1
4	1	Copper flex cable 3 cores (2C+E), min 2.5mm <sup>2</sup>	Flexible Copper, V-70 insulated, 3 core (2C+E), 3x2.5mm <sup>2</sup>	-	500	950	Single phase supply and IMI Earth Reference	Sub conduit 1
5	1	Ethernet cable, shielded fully twisted pair	Cat 6a sftp	-	500	1550		Sub conduit 2
6	1	Fibre Optic Cable	OM3 Multi Mode 2 Core	-	500	1550	Fibre is optional	



## 4.5 Conduit B – USA / Canada

STOP

Important: This section is for USA and Canada.

All cables are double insulated and must conform with all relevant local regulations

**Note:** The calculations in this table are based on site conditions as described in the Appendices. Ensure that you use the correct calculations for your site.

Cable#	Quantity	Description	Minimum recommended cable type	Marking	Termination above ground [mm]		Usage	Notes
					User Unit	Power Unit		
1	2	DC Cable class X-90 (2 DC cables), min 2/0AWG, different colours for positive, negative and earth	Flexible Copper Conductor, SDI, V-90 Insulated, 2/0AWG	-	550	1800		5.5 Reference specification for DC link – USA / Canada
2	1	1 earth conductor, min 1AWG	Flexible Copper Conductor, SDI, V-90 Insulated, 1AWG	-	250	450	Protective Earth	
3	1	Copper flex cable 2 cores, min 0.5mm <sup>2</sup>	Flexible Copper, V-70 insulated, 2 core 2x20AWG	-	450	950	Safety Loop	Sub conduit 1
4	1	Copper flex cable 3 cores (2C+E), min 2.5mm <sup>2</sup>	Flexible Copper, V-70 insulated, 3 core (2C+E), 3x14AWG	-	500	950	Single phase supply and IMI Earth Reference	Sub conduit 1
5	1	Ethernet cable, shielded fully twisted pair	Cat 6a sftp	-	500	1550		Sub conduit 2
6	1	Fibre Optic Cable	OM3 Multi Mode 2 Core	-	500	1550	Fibre is optional	Sub conduit 2

## 4.6 Remarks

The cross section (in mm<sup>2</sup>) of all conductors in the site is location specific according to relevant local laws and regulations. Verification against these regulations should be performed by the customer prior to installation.

## 5 Appendix: Reference specifications



### **STOP!**

The following information applies to sections 5.1 to 5.5 of the appendix and must be read before you continue.

The calculations used in the tables in sections 5.1 to 5.5 are examples based on site conditions that match the values in each of the tables. Ensure that you use the correct calculations for your site.

If the calculations used in the tables (thermal conductivity of soil, depth of conduit, minimum spacing of conduits) for the cable current carrying capacity do not align with the actual heat transfer paths through the soil, the cables risk overheating.

If the calculations are not done correctly, the following are some examples of the potentially dangerous results (failure modes) up to and including:

- Premature aging of the cable systems;
- Embrittlement of the cable insulation;
- Cracking/deterioration of the cables protective insulation; and/or
- Electrical arcing.

The following steps should be used for site installation:

1. Preliminary measurement of soil thermal conductivity.
2. Determine if thermally conductive backfill is required to add around the conduit.
3. Verify that the contractors have backfilled the conduits to specification, buried them at the correct depth, and spaced them adequately.
4. Perform final thermal conductivity measurements of the soil with backfill.
5. Plan for any ongoing inspections of the buried cable system.

## 5.1 Reference specification for AC link – Worldwide 400VAC



**Important:**

- This section is for all locations **except** USA and Canada.
- The calculations in this document are based on site conditions that match the values in the following table. Ensure that you use the correct calculations for your site; for examples of issues that may arise from incorrect calculations, see *Appendix: Reference specifications*.

	Value	Units	Comments
Voltage (Line-to-Line) (nominal)	400	V <sub>RMS</sub>	
Voltage (line to neutral) (nominal)	230	V <sub>RMS</sub>	
Rated power	185	kVA	
Power factor	0.99		
Maximum line current at low line level	297	A	Low line level 400V -10%
Over Current Protection Device Rating	320	A	
Soil thermal resistivity	1.0	K.m/W	
Soil temperature	20	C	
Depth of laying	1.0	m	
Conductor material	Copper		
Conductor insulation	XLPE / EPR		
Conductor temperature (maximum)	90	C	
Conductor temperature (minimum)	-40	C	
Minimum Active Conductor CSA <sup>1</sup>	2 x 70	mm <sup>2</sup>	
Minimum Earth Conductor CSA	1 x 70	mm <sup>2</sup>	
Current carrying capacity	328	A	
Maximum diameter	20	mm	
Maximum bend radius	4 x Diameter		

<sup>1</sup>Buried cable sizing as per IEC 60364 for configuration D1 – buried conduit

## 5.2 Reference specification for AC link – USA / Canada 480VAC



**Important:**

- This section is for USA and Canada.
- The calculations in this document are based on site conditions that match the values in the following table. Ensure that you use the correct calculations for your site; for examples of issues that may arise from incorrect calculations, see *Appendix: Reference specifications*.

	Value	Units	Comments
Voltage (Line-to-Line) (nominal)	480	V <sub>RMS</sub>	
Voltage (line to neutral) (nominal)	277	V <sub>RMS</sub>	
Rated power	185	kVA	
Power factor	0.99		
Maximum current at low line level	248	A	Low line level 480V -10%
Over Current Protection Device Rating	320	A	Based on 125% rule
Soil thermal resistivity	0.9	K.m/W	
Soil temperature	20	C	
Depth of laying	1.0	m	
Conductor material	Copper		
Conductor insulation	XLPE / EPR		
Conductor temperature (maximum)	90	C	
Conductor temperature (minimum)	-40	C	
Minimum Active Conductor CSA <sup>1</sup>	2 x 3/0	AWG	
Minimum Earth Conductor CSA	1 x 3/0	AWG	
Current carrying capacity	347	A	
Maximum diameter	20	mm	
Maximum bend radius	4 x Diameter		

<sup>1</sup>Buried cable sizing as per NEC – buried conduit

## 5.3 Reference specification for AC link – Canada 600VAC



### Important:

- This section is for Canada **only**.
- The calculations in this document are based on site conditions that match the values in the following table. Ensure that you use the correct calculations for your site; for examples of issues that may arise from incorrect calculations, see *Appendix: Reference specifications*.

	Value	Units	Comments
Voltage (Line-to-Line) (nominal)	600	V <sub>RMS</sub>	
Voltage (line to neutral) (nominal)	347	V <sub>RMS</sub>	
Rated power	185	kVA	
Power factor	0.99		
Maximum current at low line level	198	A	Low line level 480V -10%
Over Current Protection Device Rating	250	A	Based on 125% rule
Soil thermal resistivity	0.9	K.m/W	
Soil temperature	20	C	
Depth of laying	1.0	m	
Conductor material	Copper		
Conductor insulation	XLPE / EPR		
Conductor temperature (maximum)	90	C	
Conductor temperature (minimum)	-40	C	
Minimum Active Conductor CSA <sup>1</sup>	2 x 1/0	AWG	
Minimum Earth Conductor CSA	1 x 1/0	AWG	
Current carrying capacity	266	A	
Maximum diameter	20	mm	
Maximum bend radius	4 x Diameter		

<sup>1)</sup>Buried cable sizing as per NEC – buried conduit

## 5.4 Reference specification for DC link – Worldwide



### Important:

- This section is for all locations **except** USA and Canada.
- The calculations in this document are based on site conditions that match the values in the following table. Ensure that you use the correct calculations for your site; for examples of issues that may arise from incorrect calculations, see *Appendix: Reference specifications*.

	Value	Units	Comments
Voltage (nominal)	950	V <sub>DC</sub>	
Rated power	180	kW	
Maximum current	189	A	
Soil thermal resistivity	1.0	K.m/W	
Soil temperature	20	C	
Depth of laying	1.0	m	
Conductor material	Copper		
Conductor insulation	XLPE / EPR		
Conductor temperature (maximum)	90	C	
Conductor temperature (minimum)	-40	C	
Minimum Active Conductor CSA <sup>1</sup>	1 x 70	mm <sup>2</sup>	
Minimum Earth Conductor CSA	1 x 35	mm <sup>2</sup>	
Current carrying capacity	232	A	
Maximum diameter	20	mm	
Maximum bend radius	4 x Diameter		

<sup>1)</sup> Buried cable sizing as per IEC 60364 table B.52.3 for configuration D1 – buried conduit

## 5.5 Reference specification for DC link – USA / Canada



### Important:

- This section is for all locations **except** USA and Canada.
- The calculations in this document are based on site conditions that match the values in the following table. Ensure that you use the correct calculations for your site; for examples of issues that may arise from incorrect calculations, see *Appendix: Reference specifications*.

	Value	Units	Comments
Voltage (nominal)	950	V <sub>DC</sub>	
Rated power	180	kW	
Maximum current	189	A	
Soil thermal resistivity	0.9	K.m/W	
Soil temperature	20	C	
Depth of laying	1.0	m	
Conductor material	Copper		
Conductor insulation	XLPE / EPR		
Conductor temperature (maximum)	90	C	
Conductor temperature (minimum)	-40	C	
Minimum Active Conductor CSA <sup>1</sup>	1 x 2/0	AWG	
Minimum Earth Conductor CSA	1 x 1	AWG	
Current carrying capacity	190	A	
Maximum diameter	20	mm	
Maximum bend radius	4 x Diameter		

<sup>1</sup>)Buried cable sizing as per NEC – buried conduit

## 6 Revision record

Rev	Date	TC #	Change
1	4 February 2020	TC-1409	Document release (J Pierce, S Taylor)
2	6 July 2020	TC-1722	Added examples of issues arising from incorrect calculations to the Appendix & back references from each subsection.
3	29 April 2021	TC-2396	Update based on customer feedback.