MANUAL

(USP-300-AT)

Dual SCR Option and Dual Power

Issue date : 12 Dec 2014
Revision : 0
Comply to UL & KTL standard

Http://www.morko.com

-Contents-

1.0 BACKGROUND 3
2.0 BASIC SPECIFICATION 4
3.0 DIMENSIONS OF GENERATOR AND TRANSDUCER 5
4.0 USP INSTALLATION 6
5.0 GENERATOR ELECTRICAL DIAGRAM USP-300-AT AND GENERATOR AND TRANSDUCER MODULES 9
6.0 GENERATOR PARTS LIST 11
7.0 TRANSDUCER MODULE ASSEMBLY DIAGRAM 13
8.0 WIRING CONNECTION DIAGRAM 14
9.0 ELECTRICAL CONNECTORS, CONDUIT AND ARMORED CABLE DIAGRAM 15
10.0 SYSTEM CONFIGURATION 16
11.0 WARRANTY 17
12.0 USP TROUBLESHOOTING ALGORITHM 18

Copyright© Morko International all Rights Reserved

1.0 Background

MORKO based out of Korea, produces Ultrasonic Scale Preventer (USP) systems for use in boilers, shell and tube heat exchangers, pipe and other equipment where scale and fouling is a problem. To date MORKO has installed over 1000 USP systems around the world and some systems have been in operation since 1994.

The vibration pulses from USP prevent scale build up, because the scale breaks away with each pulse. The vibration action prevents scale from settling on the metal surface and the existing scale breaks off and continues to flow downstream. This allows for increased heat transfer efficiency, better overall heat transfer coefficient performance, longer run length, increased reliability, and lower cleaning and decontamination costs.

USP has been proven effective in many applications with different types of fouling and scale including coke, desalted crude scale, seawater mineral scale, boiler scale desalination scale, and liquor scales from pulp and paper processing. USP has been shown to be effective on both hard and soft fouling and scale.

Figure 1: Examples of Scale where USP has been applied

Copyright© Morko International all Rights Reserved

2.0 Basic Specification

The USP device (model number USP-300-AT) has been tested for use in Ex db IIC T4 Gb and is suitable for use on the heat exchangers in the hazardous area of gas & oil application.

Model	USP-300-AT
Input Frequency [Hz]	50/60 [Hz]
Input supply voltage [V]	220[V] +10% & -5%
Power consumption [W]	300[W]
Transducer No. [EA]	2[EA]
Generator weight [kg]	70[kg]
Transducer weight [kg]	6[kg]
Generator dimension [mm]	596×505×267[mm]
Ambient operational temp [℃]	-20ºC ≤ ta ≤ +50ºC

The transducer Model MOR-TD-Ex are intended to be used with the USP-300-AT ultrasonic scale preventer (generator) to transmit ultrasonic waves to prevent and/or remove fouling/scaling boilers, chillers, heat exchangers, condensers and other similar devices. The generators are voltage operated and give pulses to the transducer for the operation.

The Transducer Housing is made of SS304 and cover of aluminium alloy Al 6061-T6. The enclosure is provided with threaded enclosure and cover and moulded “o” ring of Viton provided between enclosure and cover for Ingress protection IP66 as IEC 60529.

Cable /conduit entries are provided for the accommodation of suitable flameproof cable/ conduit entry devices.

EC type Examination certificate number : ITS15ATEX18204X

Drawings reference

Title	Drawing No. :	Rev	Date	Sheet
Transducer General Assembly	EX-MS-2014-1	0	2014.09.30	1
Back Cover	EX-MS-2014-2	0	2014.09.18	1
TD Enclosure Body Drawing	EX-MS-2014-3	0	2014.09.18	1
Transducer Main Body	EX-MS-2014-4	0	2014.09.18	1
General Dimension drawing	EX-MS-2014-5	0	2014.09.18	1
General Specification	EX-MS-2014-6	0	2015.02.28	1

Conditions of Certification

Schedule of Limitations

- Only suitably certified Ex db IIC Gb -20ºC ≤ ta ≤ +50ºC IP66 cable glands, blanking elements, thread adapters to be used.
- Each entry shall have no more than one thread adapter. A blanking element shall not be used with thread adapter.
- Enclosures are to be installed in Vertical Position only.

Copyright© Morko International all Rights Reserved

3.0 Dimensions of Generator and Transducer

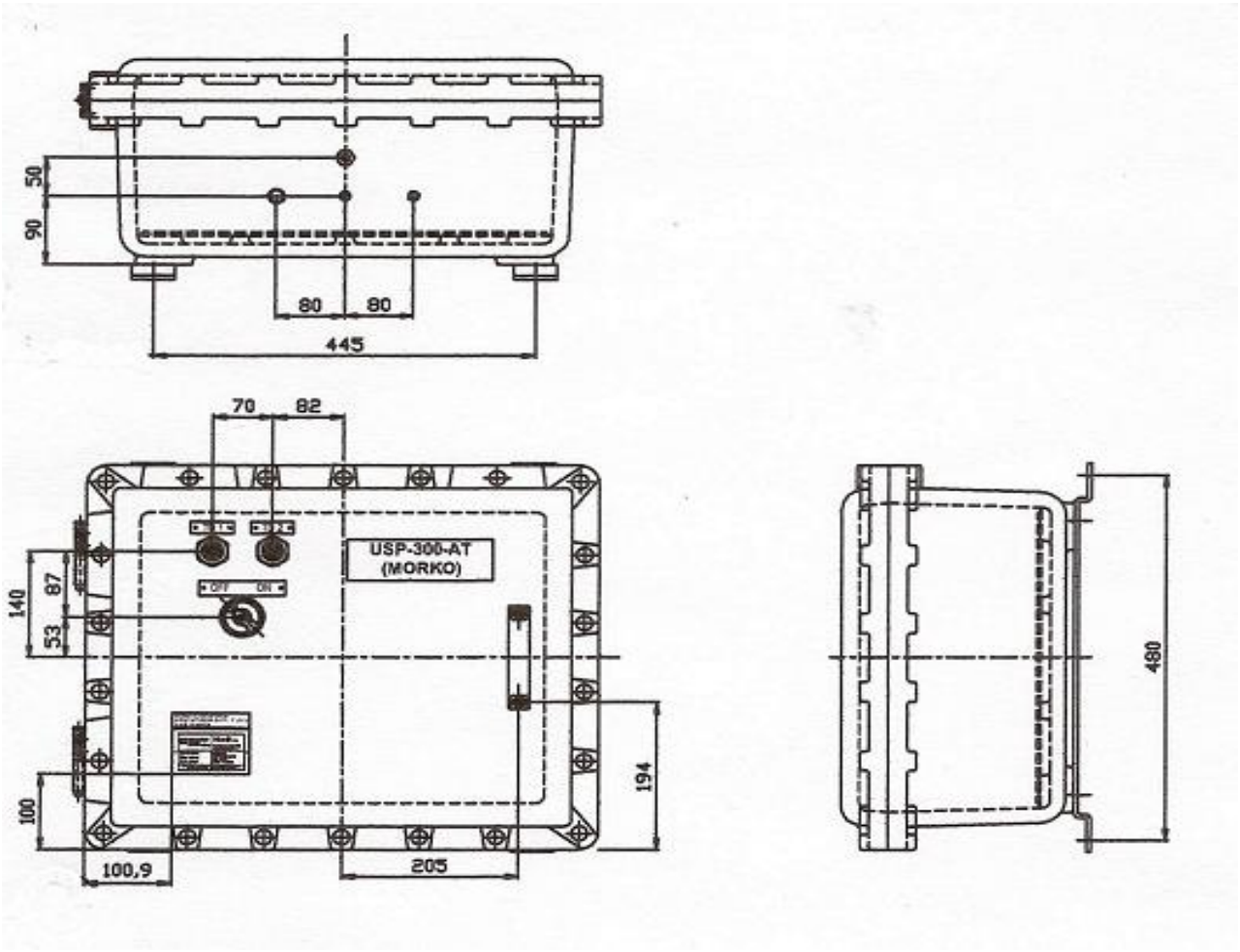


Figure 2: USP Generator Enclosure

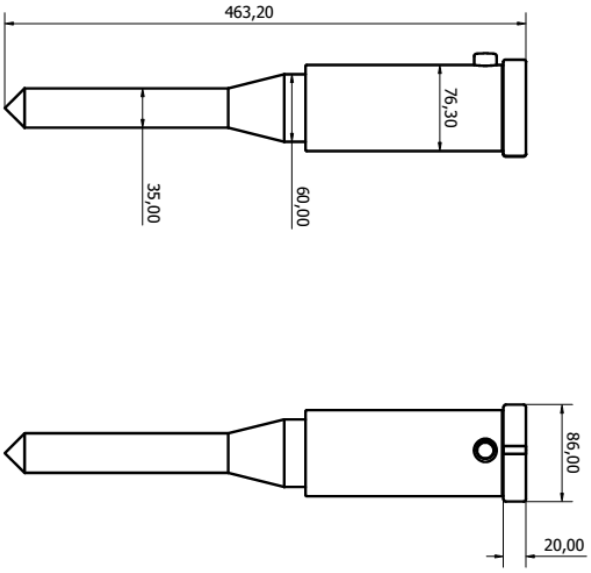


Figure 3: USP Transducer

Copyright© Morko International all Rights Reserved

4.0 USP Installation

4.1 Preparation

① MORKO will evaluate the application and give instructions with respect to the location and placement of the USP transducers(See the figure4).

② To maximize the USP effect, the USP installation should take place after the equipment has been cleaned. For heat transfer performance USP has been shown to be more effective when the system starts from a clean condition.

③ The welding process must be done while the equipment is off-line to remove the risks associated with high process fluid pressure and to eliminate flammable gases or liquids inside the process equipment barriers.

4.2 Transducer Welding Installation

① The welding should be done by a qualified expert journeyman welder under the supervision of a welding inspector.

② The welding should be done while the system is off-line and any process fluids should be removed from the system, and any pressure or flammable gases inside the vessel or process piping should be removed.

③ After cleaning and preparing the welding surface by sandpaper or grinder, the expert welder shall use the GTAW (Argon) procedure. Welding Inspection is recommended.
The welding must be done as same as the diameter of the wave guide rod. The weld bead diameter must not exceed 5mm greater than wave guide rod diameter and the inside of welding part must not contain any slag or gas bubbles to ensure there is minimal ultrasonic power losses in the weld.
(See the figures 4 and 5 below)

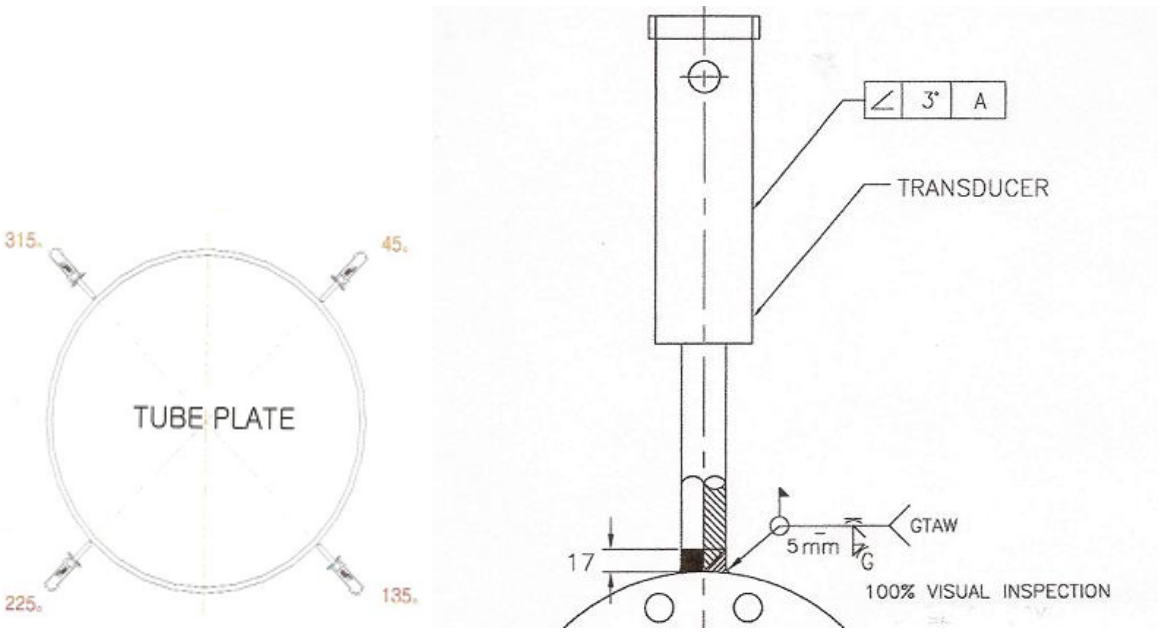


Figure 4: Example Weld Instruction Drawing

Copyright© Morko International all Rights Reserved

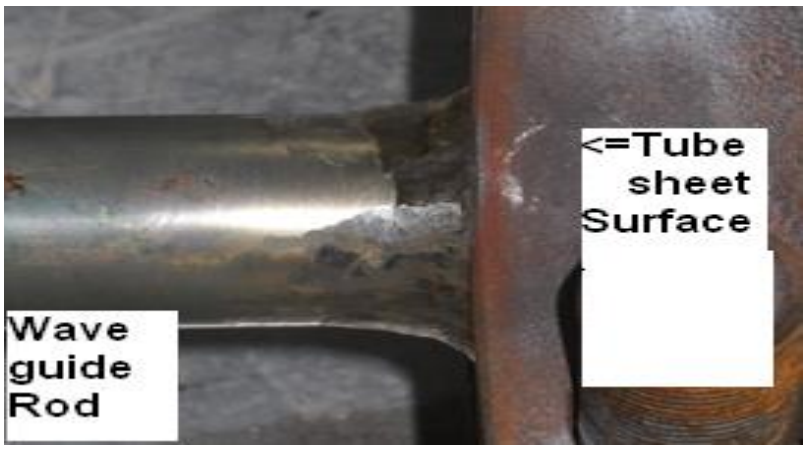


Figure 5: Example Weld

4.3 Generator Installation

① Install the USP generator in a location that will facilitate easy electrical connections between transducers, generator and the AC power supply.

② The generator should be placed in a safe location located no greater than 30 meters from transducers. The generator location should be protected from high heat, high humidity and high vibration areas and it should be easily accessible to maintenance personnel and operators. The generator housing serves to protect the generators from direct sunlight.

③ The generator should be mounted vertically on a frame or wall.

Figure 6: Typical installation: Generators with housing/shelter

4.4 Wiring Generators and Transducers

① The electric cables, cable trays and electrical conduit should be configured according to the diagrams in section 7.

② Connect the wires Generator and transducers (note the 6. wiring connection diagram)

The electrical cable spec for the transducer and generator must be:
600V FR-CVV-SB, 4* 1.5SQmm Armor shielded cable from LS Cable Co. or equivalent
Cable and cable gland should be suitable to min. 135 Deg.C

****ONLY SUITABLY CERTIFIED Ex db IIC Gb/Ex tb IIIB Db CABLE GLANDS TO BE USED**

Copyright© Morko International all Rights Reserved

The wires will be prepared with ring terminal lugs to ensure the electrical connections do not fail while in service. For a single core cable soldering is required. For multi-core cable no soldering is required. Clamping of the ring terminal lugs must be done with care to prevent any loosening during USP operation.

Figure 7: Transducer Wire Termination

The same types of ring terminal lugs are used on the generator enclosure terminals. Once these connections are made the USP generator box hardware is completed. The generator box electrical termination should look neat and organized similar to the installation figures 7 and 8.

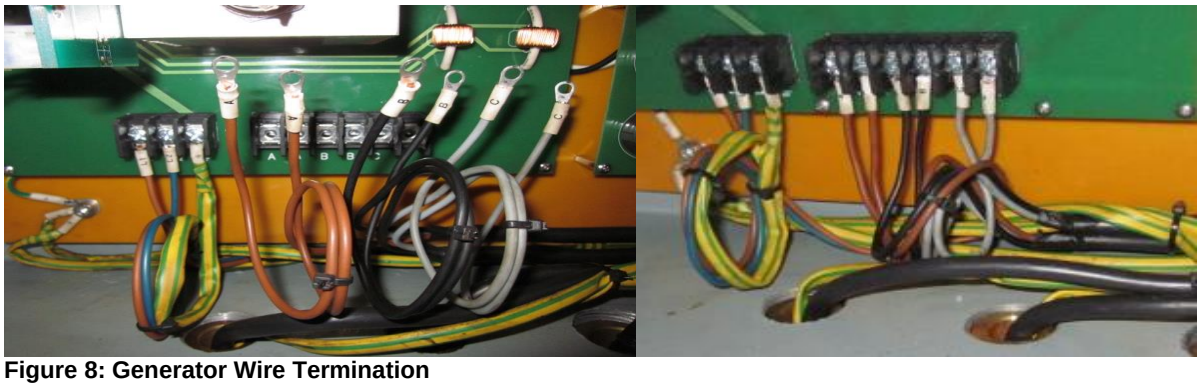


Figure 8: Generator Wire Termination

4.5 Finish Installation and Test Operation

① The final electrical termination and commissioning will be done by Morko engineers or certified distributors.

② The USP system must be tuned to operate at the optimal frequency. USP Tuning adjustment to meet the resonance frequency of ultrasonic wave and power should be done by Morko engineers or certified distributors.

Warning: To reduce the risk of ignition in hazardous atmospheres, keep the enclosure bolted closed when in operation and turn off the equipment before opening when working on the generator enclosures or transducers.

4.6 Safety Instruction

- All workers must be properly attired with safety gears
- Welding can only be done when system is offline
- Do not open the enclosure cover when in operation
- Only qualified personnel from Morko is authorized to access the USP for troubleshooting
- Works carried out 1.5m above ground must be carried out on proper scaffolding with harness

Copyright© Morko International all Rights Reserved

5.0 Generator Electrical Diagram USP-300-AT and Generator and Transducer Modules

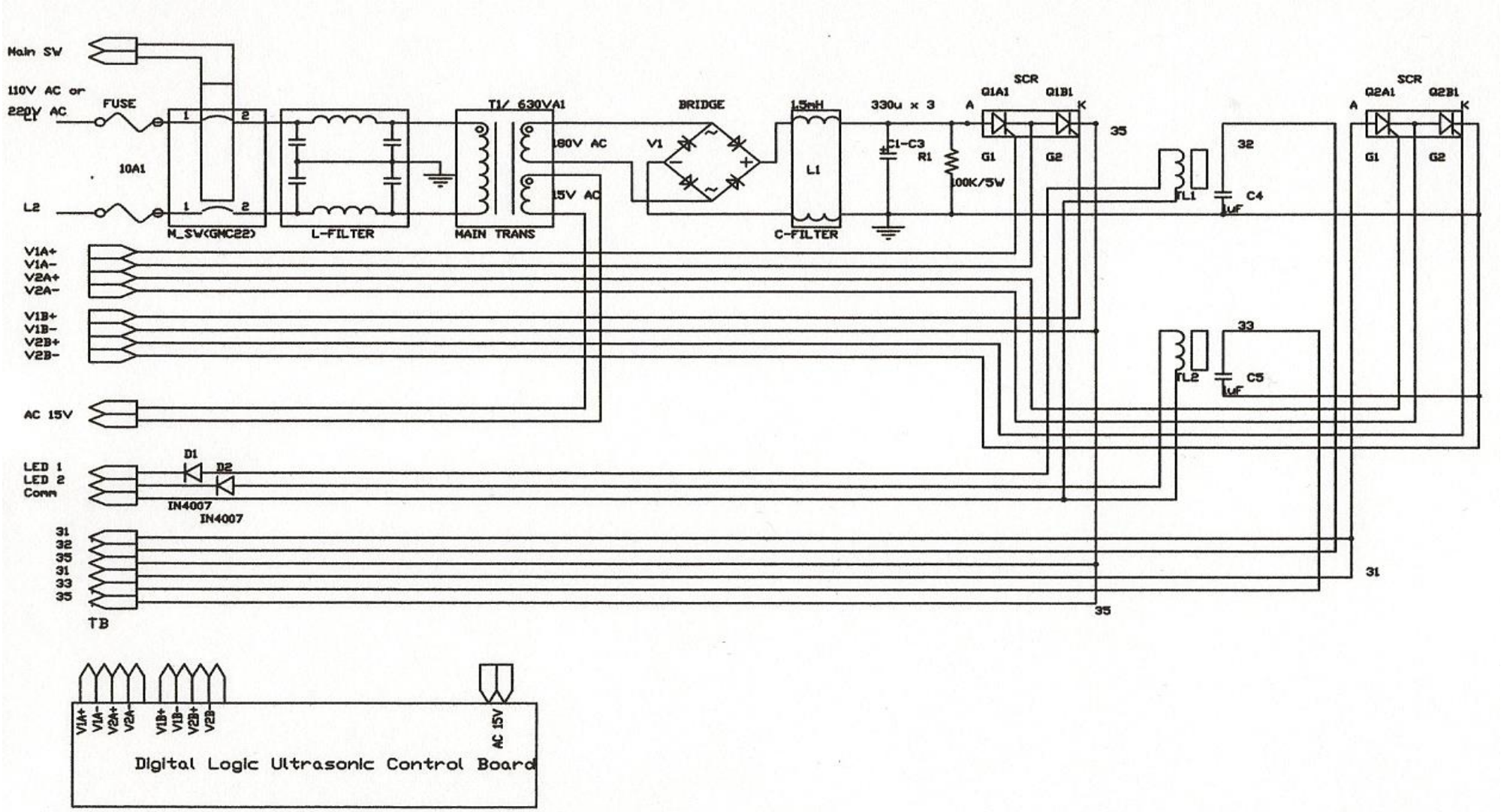


Figure 9: USP Generator Electrical Diagram for USP-300-AT

Copyright© Morko International, All Rights Reserved

Generator Module

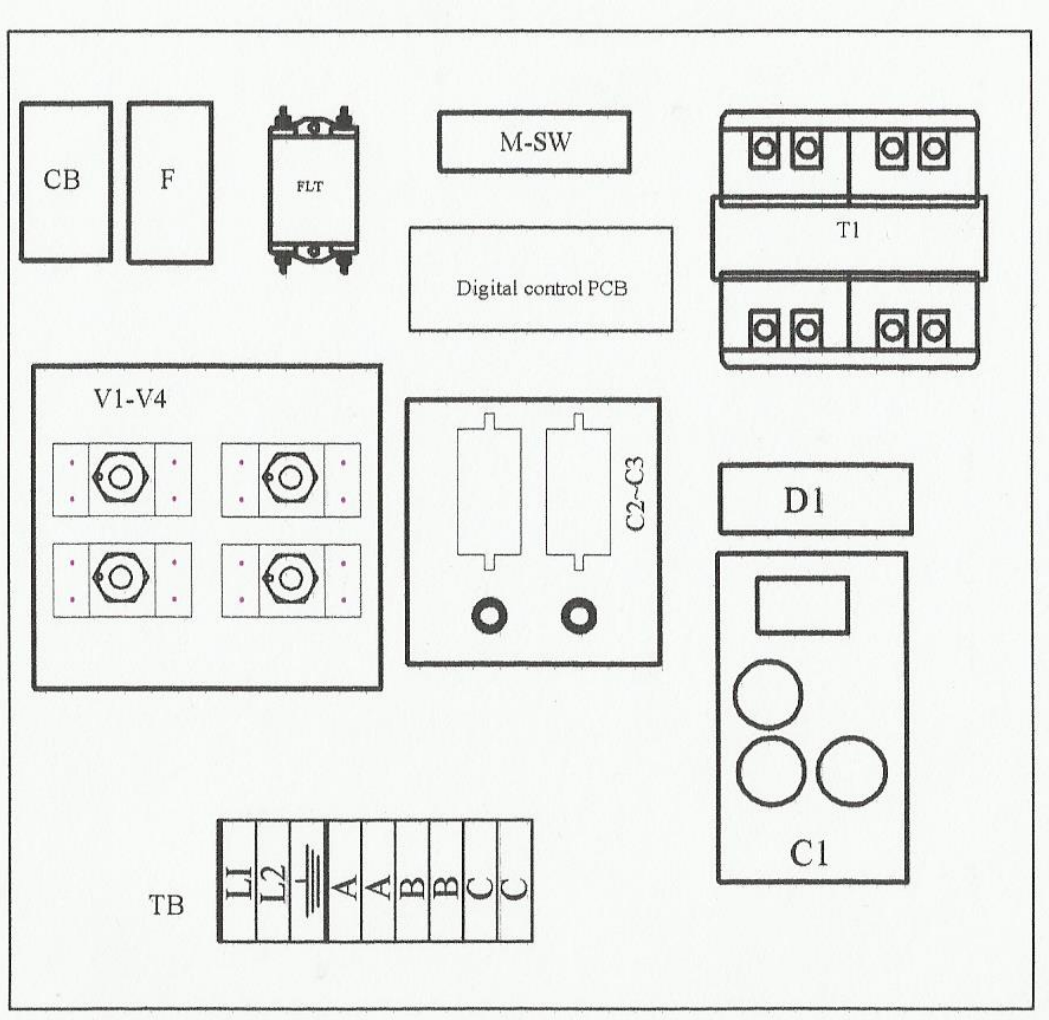


Figure 10: Generator Module Component Configuration

Transducer Module

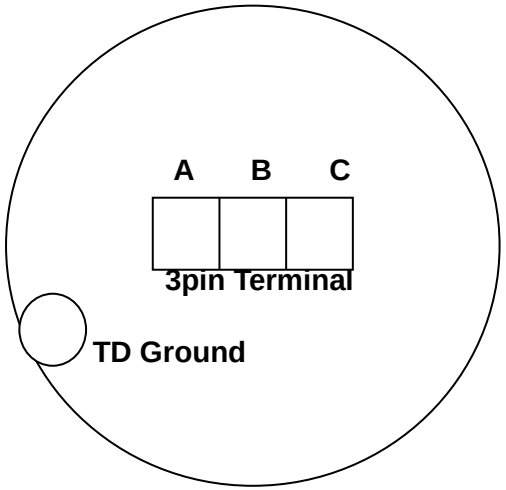


Figure 11: Transducer Module Terminal Configuration

Copyright© Morko International, All Rights Reserved

6.0 Generator Parts List

USP-300-AT Generator Module

NO	Description	Spec	Qty	Notes
V1-V4	High power Thyristor	80A	4	To be replaced every 2 years
T1	Main Transformer	630VA	1	No replacement required
M-SW	Magnet SW	GMC-22	1	No replacement required
C1	Elec. Capacitor module 105℃ inc. DC Filter	330uF x 3	1	To be replaced every 2 years
F	Fuse & holder	6A	1	Spare fuse located inside generator box
C2-C3	Switching Capacitor	1uF	2	To be replaced every 2 years
D1	Power Diode module	50A	1	To be replaced every 2 years
TB	Terminal Block	25A	1	No replacement required
N	Circuit breaker	15A	1	No replacement required
PCB	Ultrasonic control board		1	To be replaced every 2 years, spare fuse located inside gen box
LD1/LD2	Lamp Detector		2	No replacement required

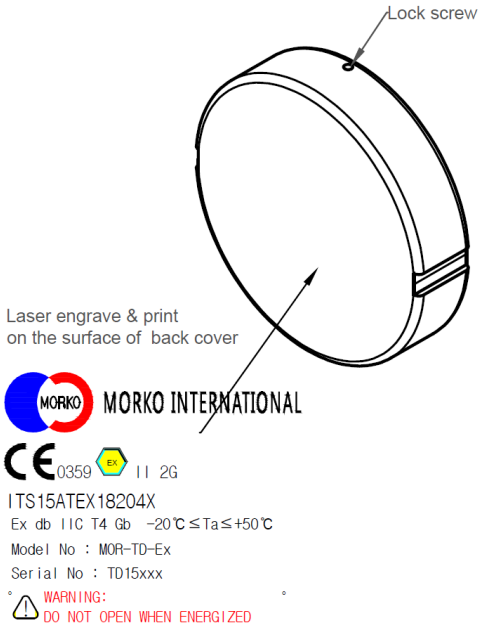
Copyright© Morko International, All Rights Reserved

Transducer module

Part List

Part No	Description	Materials	Notes
MO-TD-001	Co-Fe Transducer main body	Cobalt alloy/ carbon steel	No replacement required
MO-TD-002	Teflon wire, PFA high Temp	Electric wire	To be replaced every 4 years
MO-TD-003	Terminal PCB module	Electronic component	Inspect every 2 years
MO-TD-004	SUS Enclosure body	Stainless steel	No replacement required
MO-TD-005	Back cover	Aluminum Alloy	No replacement required
MO-TD-006	O-ring	High Temp Silicon Rubber	No replacement required
MO-TD-007	Snap-ring	Carbon steel	No replacement required

Back cover marking

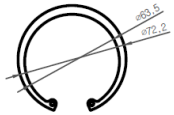


Copyright© Morko International, All Rights Reserved

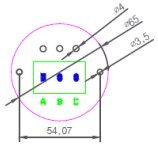
7.0 Transducer Module Assembly Diagram

NO	DESCRIPTION	MATERIAL	DRAWING No.
1	TD Main Body	SS400 Carbon steel	Ex-MS-2014-4
2	O-Ring	Fluorine(230℃)	Ex-MS-2014-3/4
3	Snap Ring	Spring Steel	
4	Terminal PCB Module	Hansaem HS-D3	
5	TD Enclosure Body	SS304 Stainless steel	Ex-MS-2014-3
6	Back Cover	AL 6061-T6	Ex-MS-2014-2
7	SUS Plate	SUS 304 Stainless steel	
8	Lock Screw(M3×0.5×L5)	SCM4	Ex-MS-2014-3
9	Lock Screw(M3×0.5×L10)	SCM4	Ex-MS-2014-2

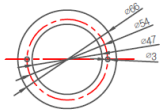
3. Snap ring (R68 Type)

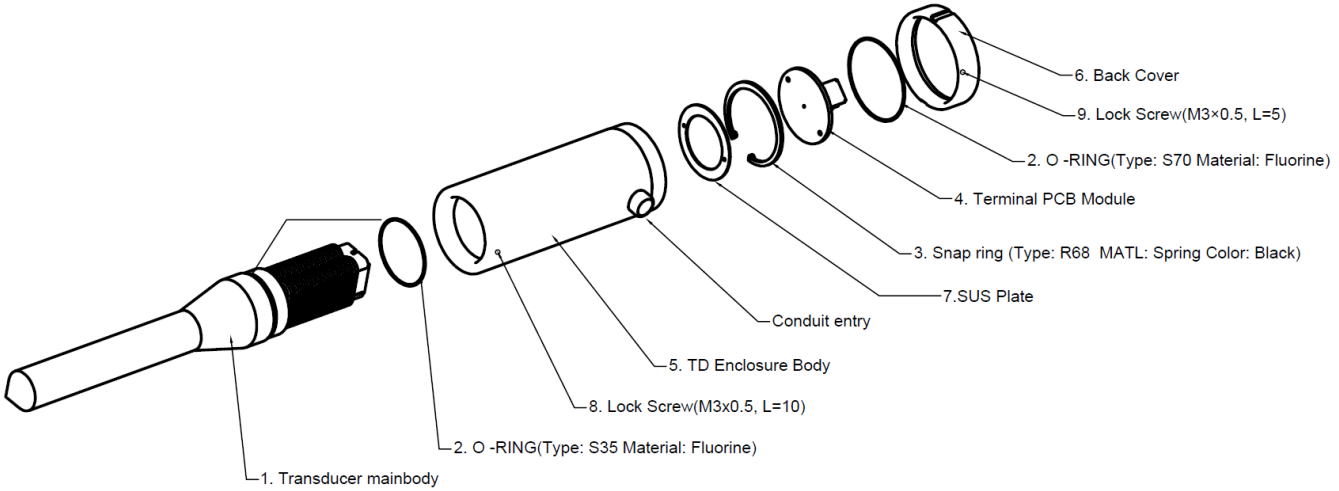


4. Terminal PCB(Thickess:2.3mm)



7. SUS Plate(Thickness: 1.2mm)





NOTE.

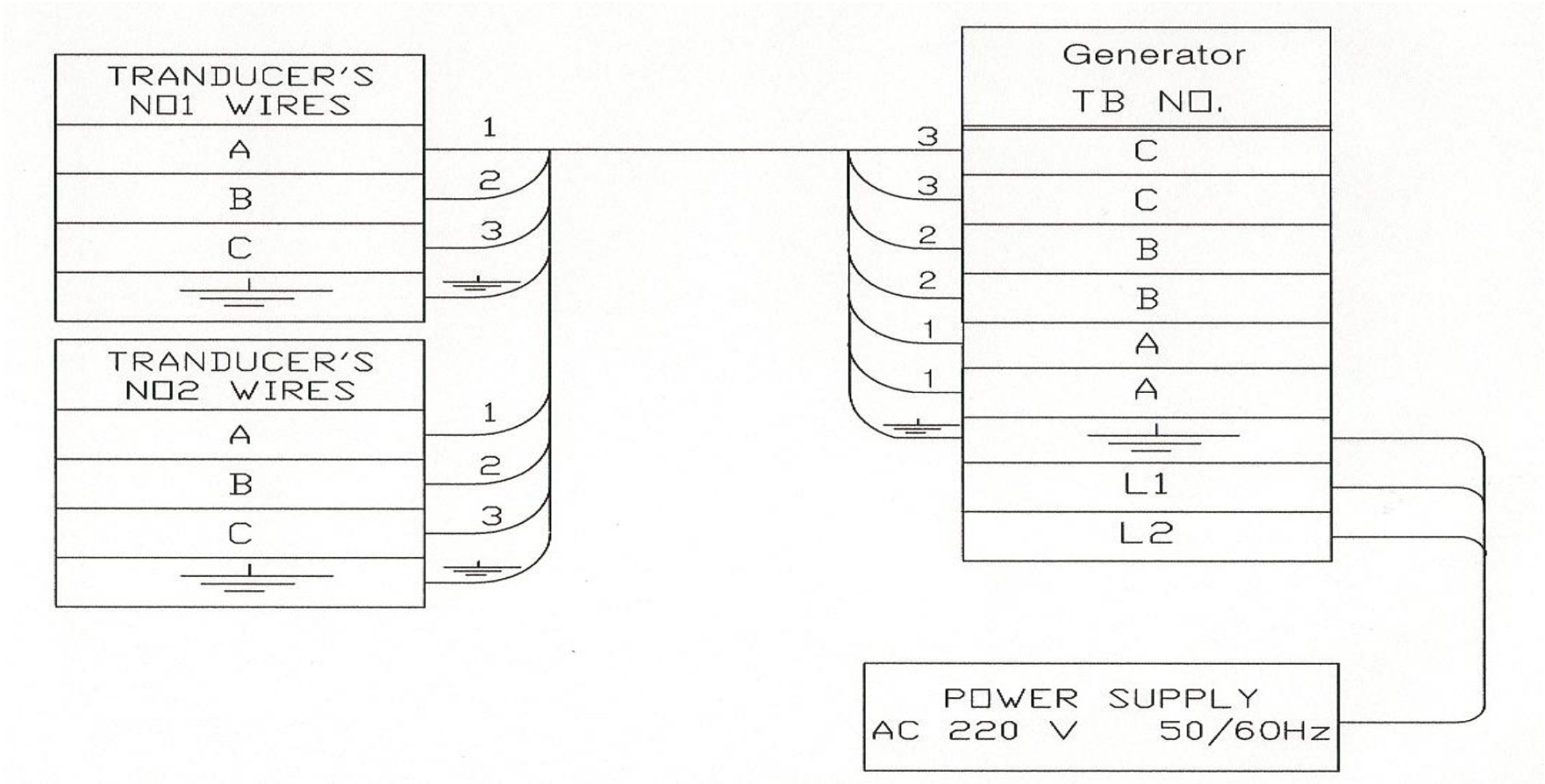
"No Modification Permitted without reference to the notified body"

REV NO. 부 호	DATE 날 짜	DESCRIPTION 적 요	REV'D 설 계	CHK'D 검 도	APP'D 승 인
⚠					

Morko international	TITLE	Transducer Gemeral Assembly	APPLICATION AREA		App'd by		SCALE	NONE	REQ'D SET
	COLOR		CLASS OF PROTECTION	Ex db IIC	Chk'd by	J.W.CHAE	Unit	mm	
	CAT NO.		DWG NO.	Ex-MS-2014-1	Drawn by	K.W. NAM	Date	2014.09.30	

Copyright© Morko International, All Rights Reserved

8.0 Wiring Connection Diagram

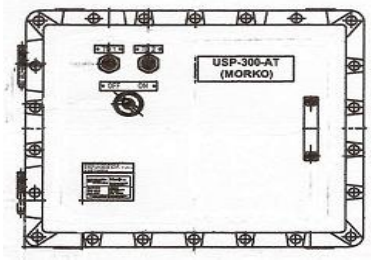


Cable Color Code & Label No for the transducer cable: A(31) <-> Red(A) C(32,33)<-> Black(C) B(35)<-> Blue(B)

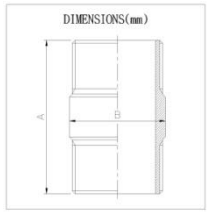
The main earth connection should be done on generator side outside of enclosure using cable size 6 sqmm.
The ground wire of transducer cable (4X1.5SQMM) connect to transducer ground earth terminal of AC supply terminal block (3 pin) with ring type lug.

Copyright© Morko International, All Rights Reserved

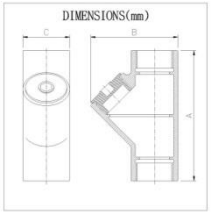
9.0 Electrical Connectors, Conduit and Armored Cable Diagram



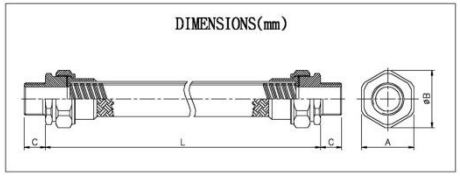
(Generator)



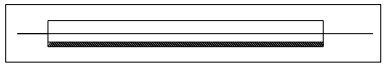
(Flameproof Union Coupling [1/2"])



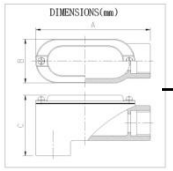
(Flameproof Sealing Fitting [1/2"])



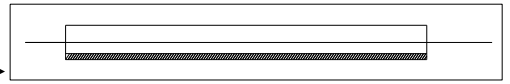
(Flameproof Flexible coupling [1/2"])



(Electric cable pipe)



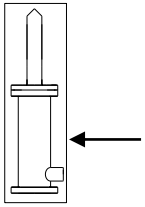
(Increased Safety Elbow [1/2"])



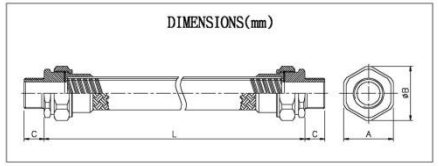
(Electric cable pipe)

(Flameproof Sealing Fitting [1/2"])

(Transducer)



(Flameproof Flexible coupling [1/2"])



Copyright© Morko International, All Rights Reserved

10.0 System Configuration

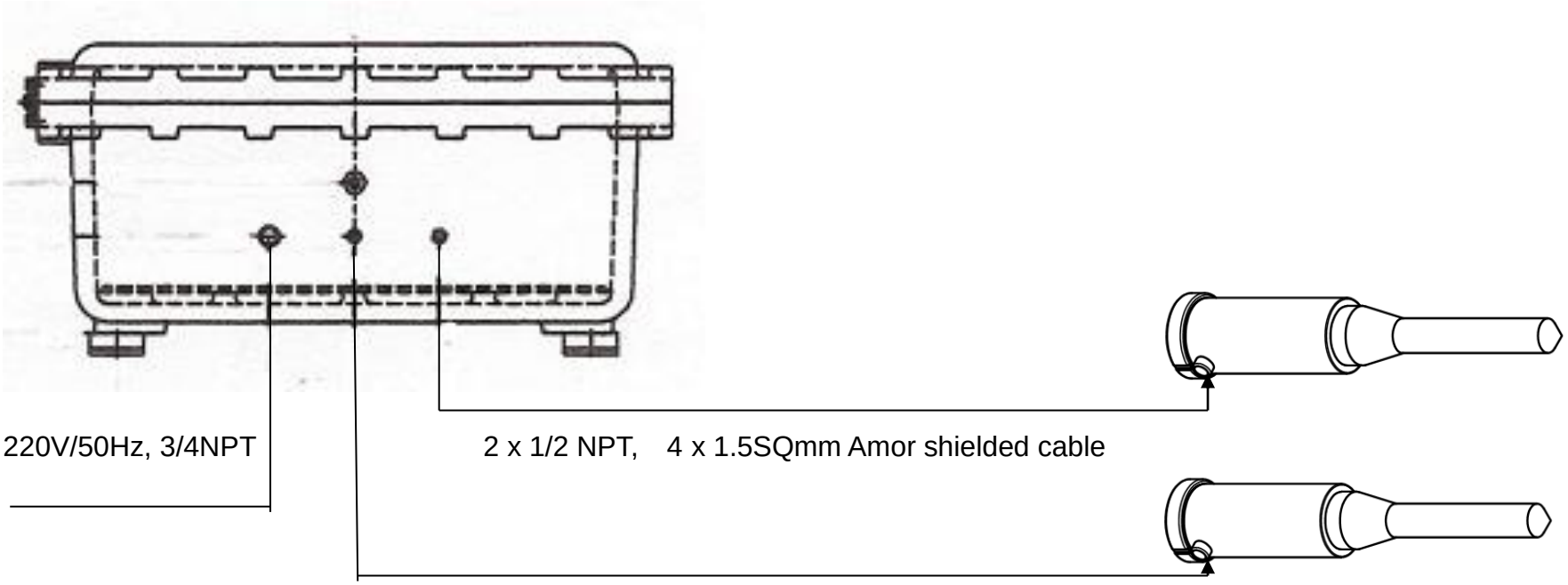


Figure 12: USP System Configuration

Copyright© Morko International, All Rights Reserved

11.0 Warranty

We sincerely thank you for purchasing the Morko Ultrasonic Scale Preventer.
This warranty is Morko's commitment of good quality and service.

The warranty is void if:

- The USP system is modified or disassembled without prior notice to MORKO.
- The USP system sustains excessive damage caused by incorrect use and/or improper operation of USP for which it was not intended.

The Morko USP's warranty covers 12 months period upon installation or 18 months after delivery, whichever comes first.

12.0 Operation Routine & Maintenance Checklist

The USP routine check should be incorporated into operation walk-about/schedule.

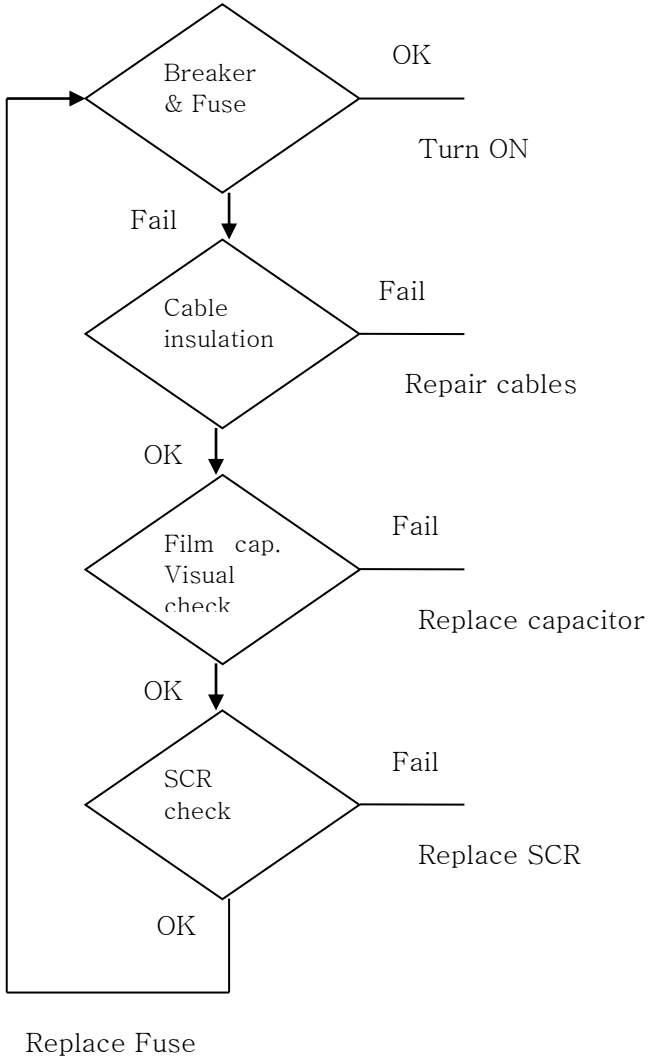
- Ensure main power is in "ON" position at all time during operation.
- Check Generator's pilot lamps LD1/LD2 to ensure lights are blinking. This indicates that the generator is power up and transducers are in operation.
- Check for audible sound coming from transducers to ensure both are working properly.
- Recommend to replace the major power components listed on page 11 and 12.

**Note: In case of any questions or emergency of USP, please contact the below before opening of generator. **
Only personnel from Morko or Morko service workshop are authorized for any change of spare parts

Vincent Chin
Prosperite PTE. Ltd.
Official Distributor to Shell of MORKO USP Products
#05-37, Primz Bizhub, 21 Woodlands Close
Singapore 737854
Tel: +65 96849849
Fax: +65 67107992
Email: Vincent.Chin@prosperite.com.sg

Copyright© Morko International, All Rights Reserved

13.0 USP Troubleshooting Algorithm



1. The transducer operation lamps are turned off then check the audible sound from transducers and no sound is detected then switch off the USP & AC supply -- Audible sound is detected then the LED lamps are failed - change the LED lamps

2. Open the USP cover and check the fuse and breaker

3. The fuse is blown off then check the insulation between each terminals (No A(31),B(32,33),C(35) and Ground(case) with Mega ohm tester(Insulation tester)

4. The insulation is OK(over 200Mohm), then check the C2/C3 capacitors with visual check

5. The C2/C3 capacitor are ok, then disconnect the socket from control board and check the SCR short test

6. SCR is replaced or OK then replace fuse and turn on USP

7. Check the AC voltage and rectified DC voltage refer to the commissioning procedure/report & turn off again & connect the control board socket & turn on USP and check the TD operation lamp & close the cover.

Copyright© Morko International, All Rights Reserved