DAEHWA
ENGINEERING
SENSOR CO., LTD.

# FINAL DRAWING

| | |
|---|---|
| Owner | |
| Ship Yard | HYUNDAI HEAVY INDUSTRIES CO., LTD. |
| Ship No. | H2649 |
| Ship Type | MULTIPURPOSE OFFSHORE CONSTRUCTION VESSEL |
| Item | LEVEL SWITCH |

| No. | Date | Description |
|---|---|---|
| **11** | **2016. 02. 03** | **for Final** |
| 10 | 2015. 10. 22 | for Re-Working |
| 9 | 2015. 04. 15 | for Re-Working |
| 8 | 2015. 01. 22 | for Re-Working |
| 7 | 2014. 12. 29 | for Re-Working |
| 6 | 2014. 11. 14 | for Re-Working |
| 5 | 2014. 08. 14 | for Re-Working |
| 4 | 2014. 07. 14 | for Working |
| 3 | 2014. 06. 23 | for Re-Approval |
| 2 | 2014. 06. 14 | for Re-Approval |
| 1 | 2013. 01. 20 | for Approval |

대화엔지니어링센서 ㈜

# Contents

**Ship No. : H2649**

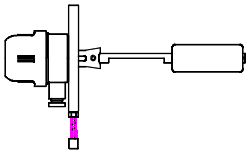
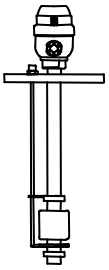
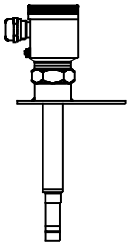


| Dwg. | Chk. | Chief |
|---|---|---|
| | | |

DAEHWA ENGINEERING SENSOR CO., LTD.

# Maker Supply Parts List

**Ship No. : H2649**

| Name / Dwg. No. | Sketch | Wgt. (kg) | Quantity 1 Ship | Model | Remark |
|---|---|---|---|---|---|
| LEVEL SWITCH<br>DX005S-H |  | 2.8 | 9 | LS-SM-D3 | Side Mounting Type<br>* With Testing Device |
| LEVEL SWITCH<br>DX007S-1FT<br>DX007S-1FT-3 |  | 5.5 | 76 | LS-TM | Top Mounting Type<br>* With Testing Device |
| ULTRASONIC LEVEL SWITCH<br>DX014-UTS-U01 |  | 2.5 | 4 | UTS 67 | Wall Mounting Type<br>* Power Supply : 24VDC<br>* Dry Condition : 7±1mA<br>* Wet Condition : 14±1mA<br>* With Welding Bracket |
| | | | | | |
| | | | | | |
| | | | | | |

# Specification
**( Side Mounting Type )**

## ■ Specification

| | | | |
|---|---|---|---|
| Application Model | : LS-SM | Max. Working Pressure | : 5kg/㎠ |
| Class | : GL, KR, DNV, BV, LR, ABS | Max. Working Temp. | : 120℃ |
| Units | : METRIC | Min. SP/GR | : 0.6 |
| IP Rating | : 56 | Insulation Resistance | : 100㏁ Min. AT 500DC |
| Switch Capacity | : AC 125V 15A, AC 250V 15A, DC 30V 6A | Dielectric Strength | : 1000V AC 50/60Hz for 1 Minute |

## ■ Service Life

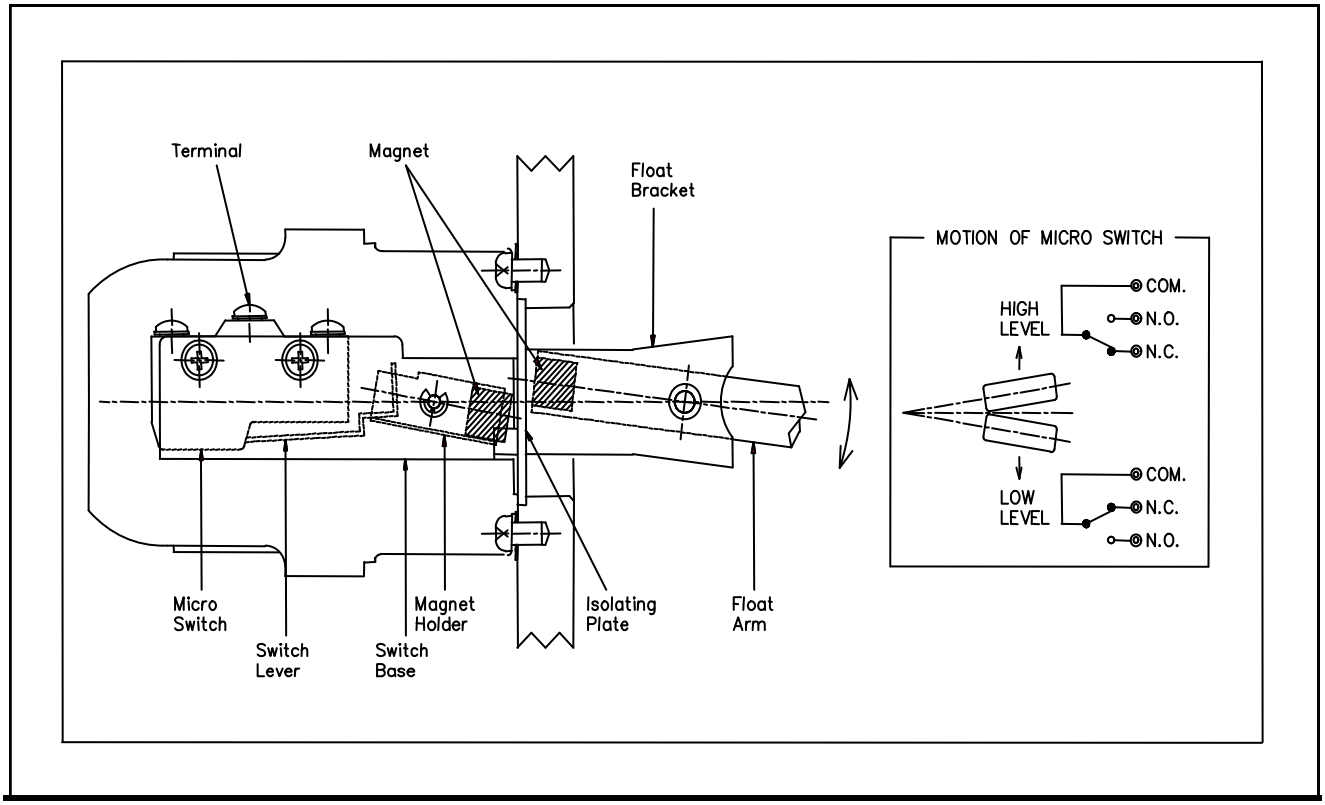
Mechanical Operations : Min. 1,500,000

Electrical Operations : Min. 1,000,000 at Switching Current

## ■ Operating Principle

A permanent magnet is fitted at the end of float arm which is located inside of tank And another magnet is connected to the micro switch lever in the terminal box located outside of the tank. The float moves up and down with liquid level in the tank. As the float reaches a certain level, the micro switch is actuated by reacting operation caused by magnetic force.

**LS-SM**



# Spec. Table for Level Switch

**Ship No. : H2649**

**LS-SM Series** (Side Mounting Type)

| No. | Tag No. (Channel) | Tank Name (Description) | Contact | Q'ty | Cable Gland | Drawing No. | Seq. No. | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | LS-1 | NO.1 M.D.O SETTLING TK L.H ( MDO-06-ST.P ) | L C H | 1 | 15C | DX005S-H | AA | P / P STOP |
| 2 | LS-5 | NO.2 M.D.O SETTLING TK L.H ( MDO-08-ST.S ) | L C H | 1 | " | DX005S-H | AA | P / P STOP |
| 3 | LS-100 | RO-07-ST.S | L C L | 1 | " | DX005S-L | AA | ELEC. HEATTER STOP |
| 4 | LS-101 | MDO-06-ST.P | L C H | 1 | " | DX005S-H | AA | P / P STOP |
| 5 | LS-102 | MDO-08-ST.S | L C H | 1 | " | DX005S-H | AA | P / P STOP |
| 6 | LS-76 | BW-02-WT.P | L C L | 1 | " | DX005S-L | AA | |
| 7 | LS-205 | COFFERDAM FOR MOONPOOL BILGE L.H | L C H | 1 | " | DX005S-H | CC | |
| 8 | LS-203 | CHAIN LOCKER BILGE WELL ( P ) BILGE L.H | L A H | 1 | " | DX005S-H | BB | |
| 9 | LS-204 | CHAIN LOCKER BILGE WELL ( S ) BILGE L.H | L A H | 1 | " | DX005S-H | BB | |
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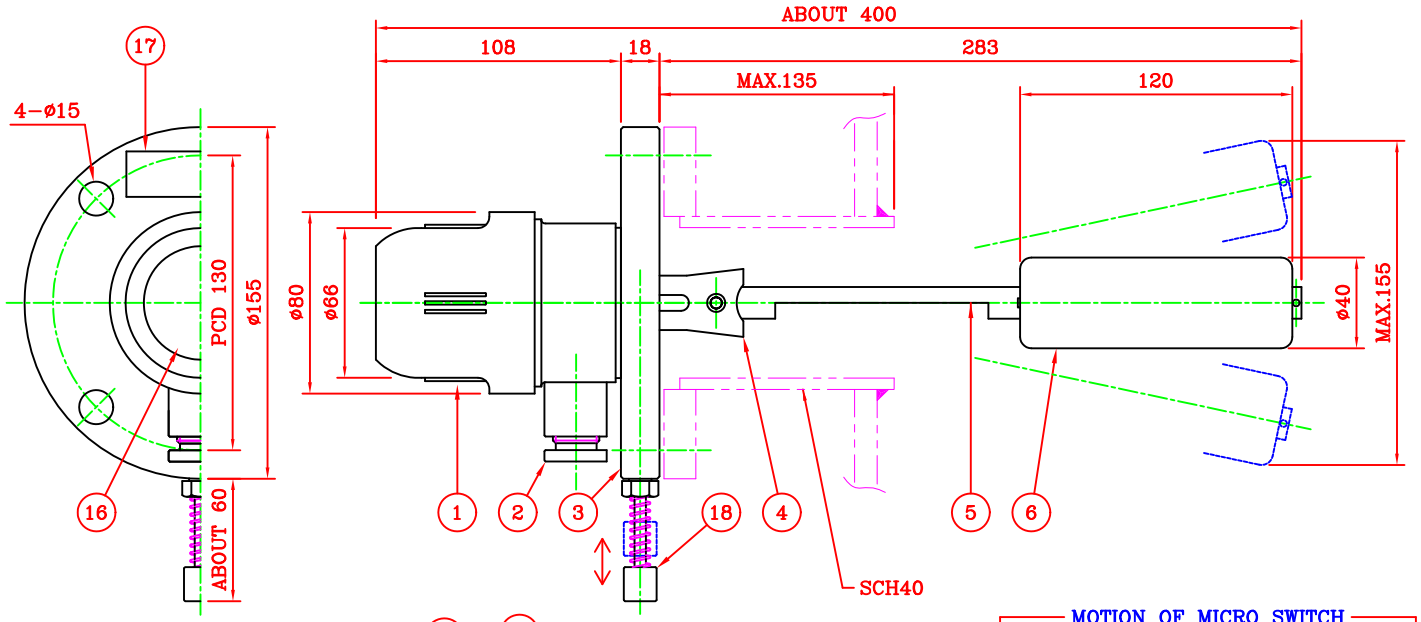
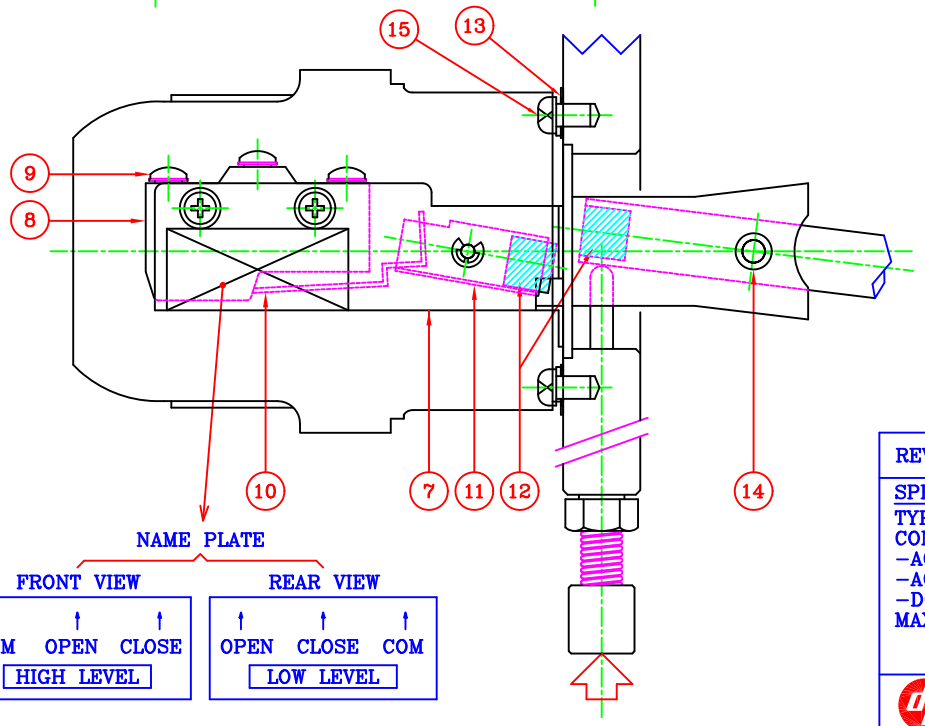
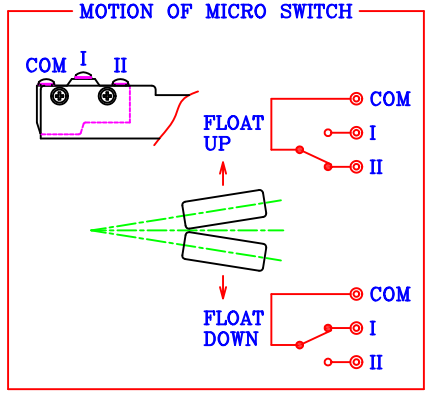


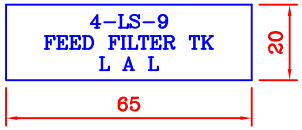







17 USE NAME PLATE (EXAMPLE)




| NO. | PART NAME | MAT'L | Q'TY | REM'S |
|---|---|---|---|---|
| 18 | TESTING DEVICE | SUS304 BsBM | 1 | |
| 17 | USE NAME PLATE | SUS304 | 1 | |
| 16 | NAME PLATE | TETRON FILM | 1 | |
| 15 | SCREW | SUS304 | 4 | M4 |
| 14 | FLOAT SHAFT | SUS304 | 1 | SPRING PIN ø5 |
| 13 | PACKING | SYNTHETIC RUBBER | 1 | |
| 12 | MAGNET | FERRITE | 2 | |
| 11 | MAGNET HOLDER | SUS304 | 1 | |
| 10 | SWITCH LEVER | SUS410 | 1 | |
| 9 | TERMINAL | CB602 | 3 | |
| 8 | MICRO SWITCH | | 1 | |
| 7 | SWITCH BASE | SUS304 | 1 | |
| 6 | FLOAT | SYNTHETIC RUBBER | 1 | |
| 5 | FLOAT ARM | SUS304 | 1 | |
| 4 | FLOAT BRACKET | SUS304 | 1 | |
| 3 | FLANGE | SS400 | 1 | JIS 5K65A |
| 2 | CABLE GLAND | BsBM | 1 | |
| 1 | SWITCH BOX | ALC | 1 | NICKEL PLATED |

| REV. | DESCRIPTION | DATE | CHK. | APP. |
|---|---|---|---|---|

SPEC.
TYPE : LS-SM-D3-65A
CONTACT CAP. (RESISTANCE LOAD)
-AC125V, 15A
-AC250V, 15A
-DC24V, 2.5A
MAX. TEMP. : 120°C

| WT. | 2.5KG |
|---|---|
| DWG. SZ. | A4 |

| SCALE | NONE | DATE | Oct. 2005 |
|---|---|---|---|
| DWG. | DSG. | CHK. | APP. |
| TITLE | LEVEL SWITCH | | |
| DWG.NO. | DX005S-L | | |

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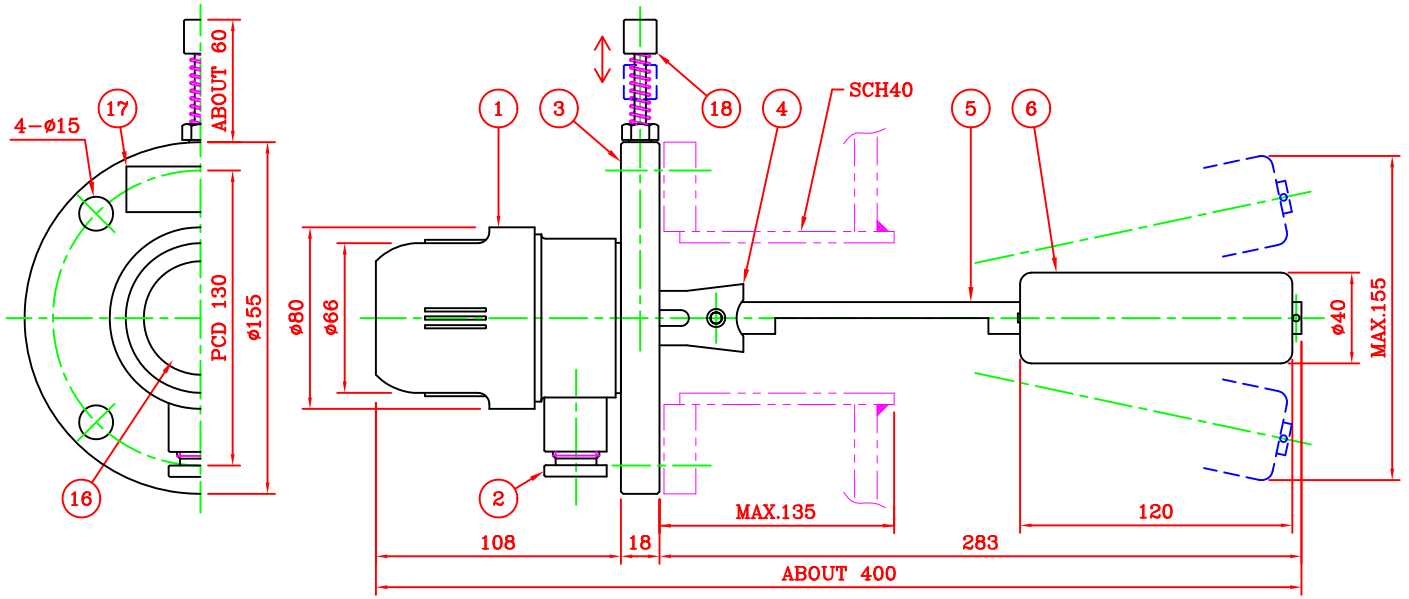
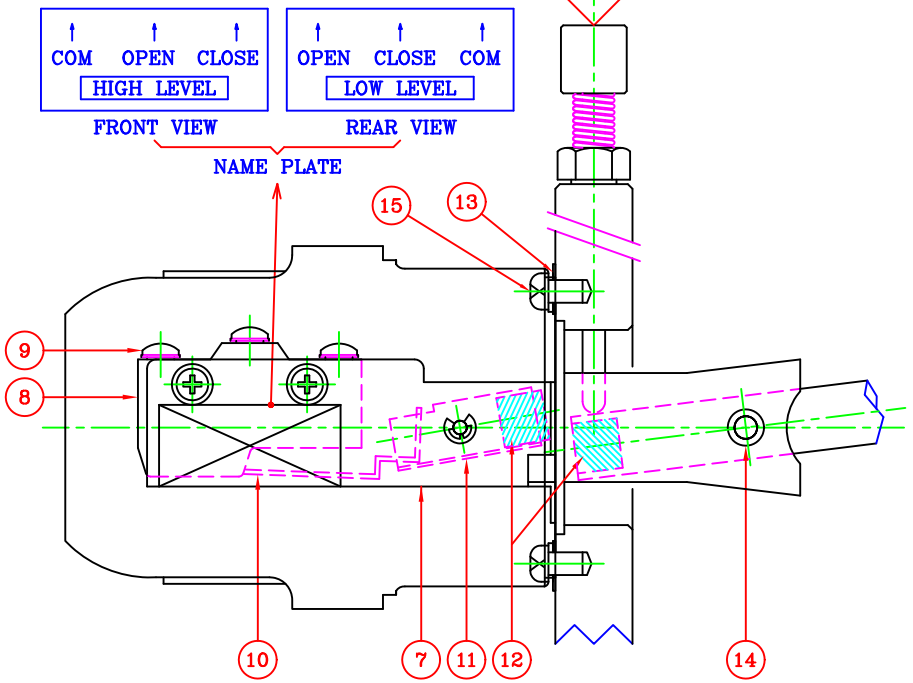
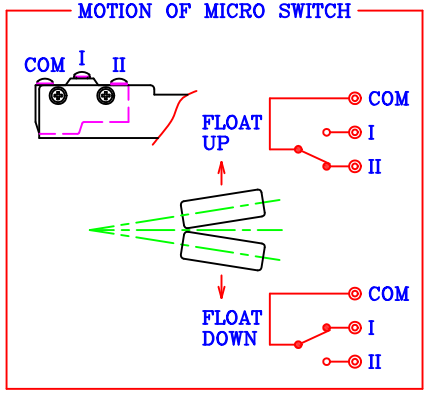



17 USE NAME PLATE (EXAMPLE)

| 4-LS-9 |
|---|
| FEED FILTER TK |
| L A H |

20 / 65




| NO. | PART NAME | MAT'L | Q'TY | REM'S |
|---|---|---|---|---|
| 18 | TESTING DEVICE | SUS304 BsBM | 1 | |
| 17 | USE NAME PLATE | SUS304 | 1 | |
| 16 | NAME PLATE | TETRON FILM | 1 | |
| 15 | SCREW | SUS304 | 4 | M4 |
| 14 | FLOAT SHAFT | SUS304 | 1 | SPRING PIN ø5 |
| 13 | PACKING | SYNTHETIC RUBBER | 1 | |
| 12 | MAGNET | FERRITE | 2 | |
| 11 | MAGNET HOLDER | SUS304 | 1 | |
| 10 | SWITCH LEVER | SUS410 | 1 | |
| 9 | TERMINAL | CB602 | 3 | |
| 8 | MICRO SWITCH | | 1 | |
| 7 | SWITCH BASE | SUS304 | 1 | |
| 6 | FLOAT | SYNTHETIC RUBBER | 1 | |
| 5 | FLOAT ARM | SUS304 | 1 | |
| 4 | FLOAT BRACKET | SUS304 | 1 | |
| 3 | FLANGE | SS400 | 1 | JIS 5K 65A |
| 2 | CABLE GLAND | BsBM | 1 | |
| 1 | SWITCH BOX | ALC | 1 | NICKEL PLATED |

| REV. | DESCRIPTION | DATE | CHK. | APP. |
|---|---|---|---|---|

SPEC.
TYPE : LS-SM-D3-65A
CONTACT CAP. (RESISTANCE LOAD)
-AC125V, 15A
-AC250V, 15A
-DC24V, 2.5A
MAX. TEMP. : 120°C

| WT. | 2.5KG |
|---|---|
| DWG. SZ. | A4 |

| SCALE | NONE | DATE | MAR. 2005 |
|---|---|---|---|
| DWG. | DSG. | CHK. | APP. |

| TITLE | LEVEL SWITCH |
|---|---|
| DWG.NO. | DX005S-H |

DAEHWA ENGINEERING

# Specification
**( Top Mounting Type )**

## ■ Specification

| | | | |
|---|---|---|---|
| Application Model | : LS-TM | Max. Working Pressure | : 5kg/㎠ |
| Class | : GL, KR, DNV, BV, LR, ABS | Max. Working Temp. | : 120℃ |
| Units | : METRIC | Min. SP/GR | : 0.6 |
| IP Rating | : 56 | Insulation Resistance | : 100㏁ Min. at 500DC |
| Switch Capacity | : 50VA | Dielectric Strength | : AC 350V, 50/60Hz for 1 Minute |

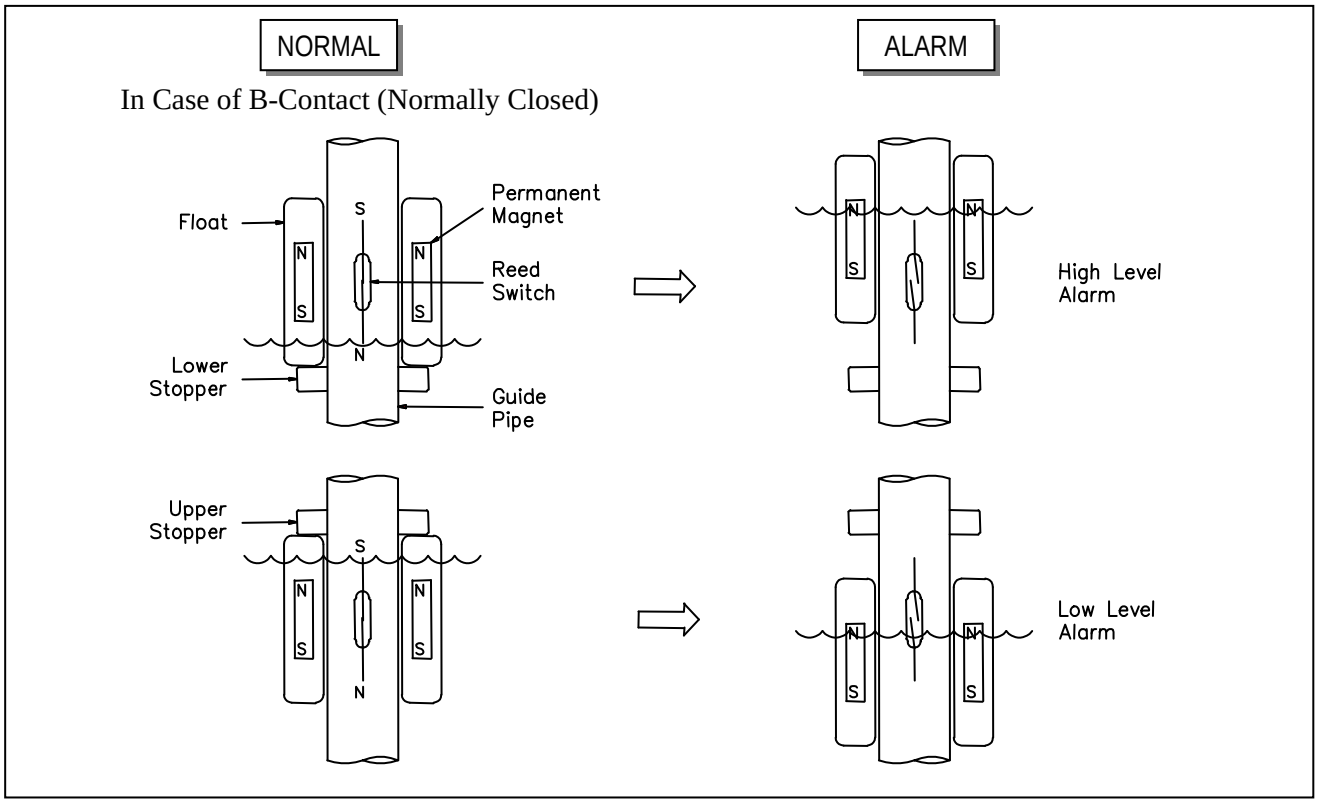
## ■ Service Life

Electrical Operations : Min. 400,000,000 at Switching Current

## ■ Operating Principle

As shown in the drawing below, permanent magnets are fitted inside of the float. The float moves up and down along the guide pipe which is made of stainless steel. Two sets of reed switches are installed inside of the guide pipe. As the float reaches a certain level, the reed switch is actuated by magnetic force.

**LS-TM**



# Spec. Table for Level Switch

**Ship No. : H2649**

**LS-TM Series** (Top Mounting Type)

| No. | Tag No. (Channel) | Tank Name | Remarks Al'rm/C'trol | Q'ty | Dwg. No. | Dimension(mm) | | | | | | | Flange | Contact Comp. | Cable Gland | IP | Seq. No. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A | B | C | D | E | F | G | | | | | | |
| *1* | LS-7 | CARGO HOLD 01 AFT DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 805 | - | - | - | 705 | 155 | 100 | 5K100A | 1 | 15C | 56 | CC | |
| *2* | LS-8 | CARGO HOLD 01 AFT MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 355 | - | - | - | 255 | 155 | 100 | " | 1 | " | " | CC | |
| *3* | LS-9 | CARGO HOLD 01 FWD DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 805 | - | - | - | 705 | 155 | 100 | " | 1 | " | " | CC | |
| *4* | LS-10 | CARGO HOLD 01 FWD MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 355 | - | - | - | 255 | 155 | 100 | " | 1 | " | " | CC | |
| *5* | LS-14 | PROPULSION ROOM T5 DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 375 | - | - | - | 275 | - | 100 | " | 1 | " | " | DD | |
| *6* | LS-15 | PROPULSION ROOM T5 MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 375 | - | - | - | 275 | - | 100 | " | 1 | " | " | DD | |
| *7* | LS-16 | PUMP ROOM 03.P DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 375 | - | - | - | 275 | - | 100 | " | 1 | " | " | DD | |
| *8* | LS-17 | PUMP ROOM 03.P MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 375 | - | - | - | 275 | - | 100 | " | 1 | " | " | DD | |
| *9* | LS-18 | CARGO HOLD 02 AFT DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 805 | - | - | - | 705 | 155 | 100 | " | 1 | " | " | CC | |
| *10* | LS-19 | CARGO HOLD 02 AFT MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 355 | - | - | - | 255 | 155 | 100 | " | 1 | " | " | CC | |

**Contact Capacity**

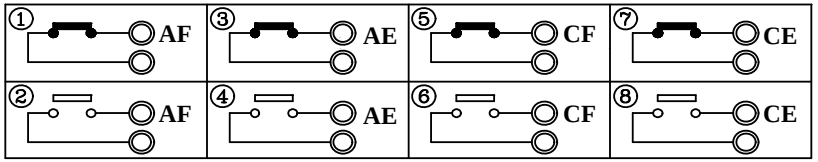
50VA
AC 250V 1A
AC 110V 2.27A
DC 24V 5.2A

**Contact Composition**

**A F :** High Level Alarm
**A E :** Low Level Alarm
**C F :** High Level Control
**C E :** Low Level Control

**Contact**

· B (Normally Closed) →
· A (Normally Open) →




※This drawing indicates normal conditions (At the point of alarm or control, contacts turn the contrary).

**DAEHWA ENGINEERING SENSOR CO., LTD.**

# Spec. Table for Level Switch

**Ship No. : H2649**

**LS-TM Series** (Top Mounting Type)

| No. | Tag No. (Channel) | Tank Name | Remarks Al'rm/C'trol | Q'ty | Dwg. No. | Dimension(mm) | | | | | | | Flange | Contact Comp. | Cable Gland | IP | Seq. No. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A | B | C | D | E | F | G | | | | | | |
| 11 | LS-13 | PROPULSION ROOM T7 ( P ) DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 375 | - | - | - | 275 | - | 100 | 5K100A | 1 | 15C | 56 | DD | |
| 12 | LS-12 | PROPULSION ROOM T7 ( P ) MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 375 | - | - | - | 275 | - | 100 | " | 1 | " | " | DD | |
| 13 | LS-21 | PROPULSION ROOM T6 DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 375 | - | - | - | 275 | - | 100 | " | 1 | " | " | DD | |
| 14 | LS-22 | PROPULSION ROOM T6 MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 375 | - | - | - | 275 | - | 100 | " | 1 | " | " | DD | |
| 15 | LS-23 | PROPULSION ROOM T7 ( S ) DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 375 | - | - | - | 275 | - | 100 | " | 1 | " | " | DD | |
| 16 | LS-24 | PROPULSION ROOM T7 ( S ) MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 375 | - | - | - | 275 | - | 100 | " | 1 | " | " | DD | |
| 17 | LS-25 | PUMP ROOM 03.S DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 375 | - | - | - | 275 | - | 100 | " | 1 | " | " | DD | |
| 18 | LS-26 | PUMP ROOM 03.S MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 375 | - | - | - | 275 | - | 100 | " | 1 | " | " | DD | |
| 19 | LS-27 | CARGO HOLD 02 FWD DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 805 | - | - | - | 705 | 155 | 100 | " | 1 | " | " | CC | |
| 20 | LS-28 | CARGO HOLD 02 FWD MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 355 | - | - | - | 255 | 155 | 100 | " | 1 | " | " | CC | |

**Contact Capacity**

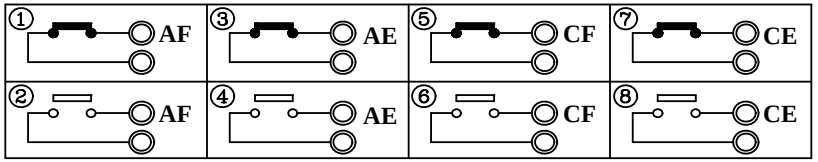
50VA
AC 250V 1A
AC 110V 2.27A
DC 24V 5.2A

**Contact Composition**

**A F :** High Level Alarm
**A E :** Low Level Alarm
**C F :** High Level Control
**C E :** Low Level Control

**Contact**

· B (Normally Closed) →
· A (Normally Open) →




※This drawing indicates normal conditions (At the point of alarm or control, contacts turn the contrary).

**DAEHWA ENGINEERING SENSOR CO., LTD.**

# Spec. Table for Level Switch

**Ship No. : H2649**

**LS-TM Series** (Top Mounting Type)

| No. | Tag No. (Channel) | Tank Name | Remarks Al'rm/C'trol | Q'ty | Dwg. No. | Dimension(mm) | | | | | | | Flange | Contact Comp. | Cable Gland | IP | Seq. No. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A | B | C | D | E | F | G | | | | | | |
| 21 | LS-46 | PIPE TUNNEL ( P, FWD ) DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 550 | - | - | - | 450 | 16 | 100 | 5K100A | 1 | 15C | 56 | AA | |
| 22 | LS-47 | PIPE TUNNEL ( P, FWD ) MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 400 | - | - | - | 300 | 16 | 100 | " | 1 | " | " | AA | |
| 23 | LS-63 | HPR ( P, FWD ) MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 300 | - | - | - | 200 | - | 100 | " | 1 | " | " | CC | |
| 24 | LS-64 | ENGINE ROOM 01.S ( PUMP SPACE ) MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 500 | - | - | - | 400 | 300 | 100 | " | 1 | " | " | AA | |
| 25 | LS-65 | ENGINE ROOM 01.S ( PUMP SPACE ) DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 850 | - | - | - | 750 | 300 | 100 | " | 1 | " | " | AA | |
| 26 | LS-66 | ENGINE ROOM 01.P MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 500 | - | - | - | 400 | 300 | 100 | " | 1 | " | " | AA | |
| 27 | LS-67 | ENGINE ROOM 01.P DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 850 | - | - | - | 750 | 300 | 100 | " | 1 | " | " | AA | |
| 28 | LS-68 | ENGINE ROOM 01.P ( PURIFIER ROOM ) MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 500 | - | - | - | 400 | 300 | 100 | " | 1 | " | " | AA | |
| 29 | LS-69 | ENGINE ROOM 01.P ( PURIFIER ROOM ) DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 850 | - | - | - | 750 | 300 | 100 | " | 1 | " | " | AA | |
| 30 | LS-70 | THRUSTER ROOM T4 MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 350 | - | - | - | 250 | 150 | 100 | " | 1 | " | " | BB | |

**Contact Capacity**

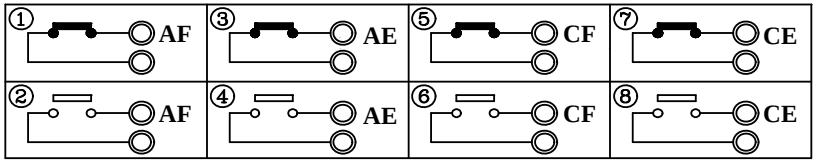
50VA
AC 250V 1A
AC 110V 2.27A
DC 24V 5.2A

**Contact Composition**

**A F :** High Level Alarm
**A E :** Low Level Alarm
**C F :** High Level Control
**C E :** Low Level Control

**Contact**

· B (Normally Closed) →
· A (Normally Open) →

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**DAEHWA ENGINEERING SENSOR CO., LTD.**

# Spec. Table for Level Switch

**Ship No. : H2649**

**LS-TM Series** (Top Mounting Type)

| No. | Tag No. (Channel) | Tank Name | Remarks Al'rm/C'trol | Q'ty | Dwg. No. | Dimension(mm) | | | | | | | Flange | Contact Comp. | Cable Gland | IP | Seq. No. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A | B | C | D | E | F | G | | | | | | |
| 31 | LS-48 | PIPE TUNNEL ( S, FWD ) DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 550 | - | - | - | 450 | 16 | 100 | 5K100A | 1 | 15C | 56 | AA | |
| 32 | LS-49 | PIPE TUNNEL ( S, FWD ) MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 400 | - | - | - | 300 | 16 | 100 | " | 1 | " | " | AA | |
| 33 | LS-50 | HPR ( S, FWD ) MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 300 | - | - | - | 200 | - | 100 | " | 1 | " | " | CC | |
| 34 | LS-51 | CRANE EQUIP'T AREA ( P ) DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 800 | - | - | - | 700 | 150 | 100 | " | 1 | " | " | CC | |
| 35 | LS-52 | CRANE EQUIP'T AREA ( P ) MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 350 | - | - | - | 250 | 150 | 100 | " | 1 | " | " | CC | |
| 36 | LS-53 | CRANE EQUIP'T AREA ( S ) DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 800 | - | - | - | 700 | 150 | 100 | " | 1 | " | " | CC | |
| 37 | LS-54 | CRANE EQUIP'T AREA ( S ) MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 350 | - | - | - | 250 | 150 | 100 | " | 1 | " | " | CC | |
| 38 | LS-55 | PUMP ROOM 02.P MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 500 | - | - | - | 400 | 300 | 100 | " | 1 | " | " | AA | |
| 39 | LS-56 | PUMP ROOM 02.P DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 850 | - | - | - | 750 | 300 | 100 | " | 1 | " | " | AA | |
| 40 | LS-57 | PURIFIER ROOM 02.S MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 500 | - | - | - | 400 | 300 | 100 | " | 1 | " | " | AA | |

**Contact Capacity**

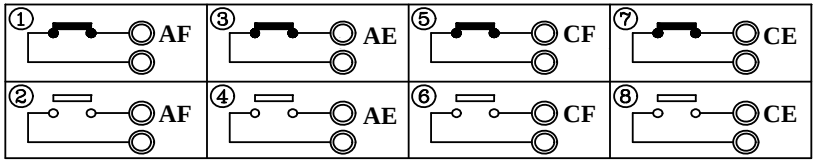
50VA
AC 250V 1A
AC 110V 2.27A
DC 24V 5.2A

**Contact Composition**

**A F :** High Level Alarm
**A E :** Low Level Alarm
**C F :** High Level Control
**C E :** Low Level Control

**Contact**

· B (Normally Closed) →
· A (Normally Open) →




※This drawing indicates normal conditions (At the point of alarm or control, contacts turn the contrary).

**DAEHWA ENGINEERING SENSOR CO., LTD.**

# Spec. Table for Level Switch

**Ship No. : H2649**

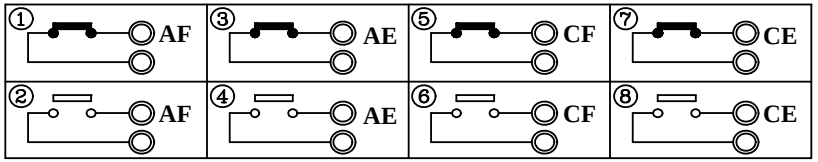
**LS-TM Series** (Top Mounting Type)

| No. | Tag No. (Channel) | Tank Name | Remarks Al'rm/C'trol | Q'ty | Dwg. No. | Dimension(mm) | | | | | | | Flange | Contact Comp. | Cable Gland | IP | Seq. No. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A | B | C | D | E | F | G | | | | | | |
| 41 | LS-58 | PURIFIER ROOM 02.S DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 850 | - | - | - | 750 | 300 | 100 | 5K100A | 1 | 15C | 56 | AA | |
| 42 | LS-59 | ENGINE ROOM 02.S MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 500 | - | - | - | 400 | 300 | 100 | " | 1 | " | " | AA | |
| 43 | LS-60 | ENGINE ROOM 02.S DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 850 | - | - | - | 750 | 300 | 100 | " | 1 | " | " | AA | |
| 44 | LS-61 | ENGINE ROOM 02.P MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 500 | - | - | - | 400 | 300 | 100 | " | 1 | " | " | AA | |
| 45 | LS-62 | ENGINE ROOM 02.P DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 850 | - | - | - | 750 | 300 | 100 | " | 1 | " | " | AA | |
| 46 | LS-41 | HPR ( P, AFT ) MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 300 | - | - | - | 200 | - | 100 | " | 1 | " | " | CC | |
| 47 | LS-42 | PIPE TUNNEL ( P, AFT ) DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 450 | - | - | - | 350 | - | 100 | " | 1 | " | " | CC | |
| 48 | LS-43 | PIPE TUNNEL ( P, AFT ) MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 300 | - | - | - | 200 | - | 100 | " | 1 | " | " | CC | |
| 49 | LS-44 | PIPE TUNNEL ( S, AFT ) DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 450 | - | - | - | 350 | - | 100 | " | 1 | " | " | CC | |
| 50 | LS-45 | PIPE TUNNEL ( S, AFT ) MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 300 | - | - | - | 200 | - | 100 | " | 1 | " | " | CC | |

**Contact Capacity**
50VA
AC 250V 1A
AC 110V 2.27A
DC 24V 5.2A

**Contact Composition**
**A F :** High Level Alarm
**A E :** Low Level Alarm
**C F :** High Level Control
**C E :** Low Level Control

**Contact**
· B (Normally Closed) →
· A (Normally Open) →




※This drawing indicates normal conditions (At the point of alarm or control, contacts turn the contrary).

**DAEHWA ENGINEERING SENSOR CO., LTD.**

# Spec. Table for Level Switch

**Ship No. : H2649**

**LS-TM Series** (Top Mounting Type)

| No. | Tag No. (Channel) | Tank Name | Remarks Al'rm/C'trol | Q'ty | Dwg. No. | Dimension(mm) | | | | | | | Flange | Contact Comp. | Cable Gland | IP | Seq. No. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A | B | C | D | E | F | G | | | | | | |
| 51 | LS-71 | THRUSTER ROOM T4 DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 800 | - | - | - | 700 | 150 | 100 | 5K100A | 1 | 15C | 56 | BB | |
| 52 | LS-72 | THRUSTER ROOM T1 MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 350 | - | - | - | 250 | 150 | 100 | " | 1 | " | " | BB | |
| 53 | LS-73 | THRUSTER ROOM T1 DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 800 | - | - | - | 700 | 150 | 100 | " | 1 | " | " | BB | |
| 54 | LS-74 | BI-07-BB.C | L C L | 1 | DX007S-1FT-3 | 2360 | - | 2260 | - | - | 300 | 100 | " | 7 | " | " | AA | P / P STOP |
| 55 | LS-75 | GW-06-DB.C | L C L | 1 | DX007S-1FT-3 | 2420 | - | 2320 | - | - | 300 | 100 | " | 7 | " | " | AA | P / P STOP |
| 56 | LS-83 | THRUSTER ROOM T3 MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 350 | - | - | - | 250 | 150 | 100 | " | 1 | " | " | BB | |
| 57 | LS-84 | THRUSTER ROOM T3 DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 800 | - | - | - | 700 | 150 | 100 | " | 1 | " | " | BB | |
| 58 | LS-85 | THRUSTER ROOM T2 MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 350 | - | - | - | 250 | 150 | 100 | " | 1 | " | " | BB | |
| 59 | LS-86 | THRUSTER ROOM T2 DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 800 | - | - | - | 700 | 150 | 100 | " | 1 | " | " | BB | |
| 60 | LS-201 | CHAIN LOCKER FOR CRANE EQUIPMENT SPACE MAIN BILGE L.H | L A H | 1 | DX007S-1FT | 670 | - | - | - | 570 | 150 | 100 | " | 1 | " | " | CC | |

**Contact Capacity**

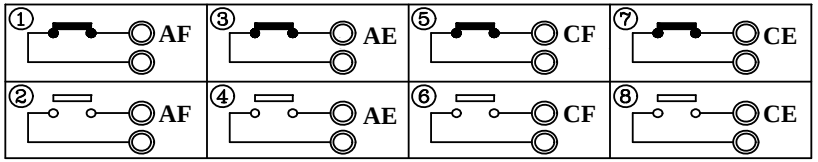
50VA
AC 250V 1A
AC 110V 2.27A
DC 24V 5.2A

**Contact Composition**

**A F :** High Level Alarm
**A E :** Low Level Alarm
**C F :** High Level Control
**C E :** Low Level Control

**Contact**

· B (Normally Closed) →
· A (Normally Open) →




※This drawing indicates normal conditions (At the point of alarm or control, contacts turn the contrary).

# Spec. Table for Level Switch

**Ship No. : H2649**

**LS-TM Series** (Top Mounting Type)

| No. | Tag No. (Channel) | Tank Name | Remarks Al'rm/C'trol | Q'ty | Dwg. No. | Dimension(mm) | | | | | | | Flange | Contact Comp. | Cable Gland | IP | Seq. No. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A | B | C | D | E | F | G | | | | | | |
| 61 | LS-202 | CHAIN LOCKER FOR CRANE EQUIPMENT SPACE DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 820 | - | - | - | 720 | 150 | 100 | 5K100A | 1 | 15C | 56 | CC | |
| 62 | LS-73A | THRUSTER ROOM T1 ( AFT ) DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 800 | - | - | - | 700 | 150 | 100 | " | 1 | " | " | BB | |
| 63 | LS-86A | THRUSTER ROOM T2 ( AFT ) DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 800 | - | - | - | 700 | 150 | 100 | " | 1 | " | " | BB | |
| 64 | LS-51A | CRANE EQUIP'T AREA ( AFT-P) DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 600 | - | - | - | 500 | 150 | 100 | " | 1 | " | " | - | |
| 65 | LS-53A | CRANE EQUIP'T AREA ( AFT-S) DAILY BILGE L.H | L A H | 1 | DX007S-1FT | 600 | - | - | - | 500 | 150 | 100 | " | 1 | " | " | - | |
| 66 | LS-86B | D.S LOG COMP'T BILGE L.H | L A H | 1 | DX007S-1FT | 300 | - | - | - | 200 | - | 100 | " | 1 | " | " | - | |
| 67 | LS-91 | SWBD RM 02 ( F ) FWD PIPE FLANGE JOINT WATER LEAK L.H | L A H | 1 | DX007S-1FT | 360 | - | - | - | 260 | - | 100 | " | 1 | " | " | - | |
| 68 | LS-92 | SWBD RM 02 ( A ) AFT PIPE FLANGE JOINT WATER LEAK L.H | L A H | 1 | DX007S-1FT | 360 | - | - | - | 260 | - | 100 | " | 1 | " | " | - | |
| 69 | LS-93 | SWBD RM 02 ( S ) PIPE FLANGE JOINT WATER LEAK L.H | L A H | 1 | DX007S-1FT | 360 | - | - | - | 260 | - | 100 | " | 1 | " | " | - | |
| 70 | LS-94 | E.E.R 02 ( F ) PIPE FLANGE JOINT WATER LEAK L.H | L A H | 1 | DX007S-1FT | 360 | - | - | - | 260 | - | 100 | " | 1 | " | " | - | |

**Contact Capacity**

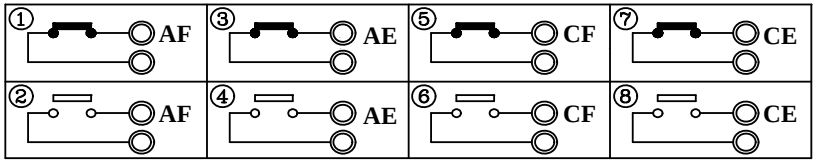
50VA
AC 250V 1A
AC 110V 2.27A
DC 24V 5.2A

**Contact Composition**

**A F :** High Level Alarm
**A E :** Low Level Alarm
**C F :** High Level Control
**C E :** Low Level Control

**Contact**

· B (Normally Closed) →
· A (Normally Open) →




※This drawing indicates normal conditions (At the point of alarm or control, contacts turn the contrary).

# Spec. Table for Level Switch

**Ship No. : H2649**

**LS-TM Series** (Top Mounting Type)

| No. | Tag No. (Channel) | Tank Name | Remarks Al'rm/C'trol | Q'ty | Dwg. No. | Dimension(mm) | | | | | | | Flange | Contact Comp. | Cable Gland | IP | Seq. No. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A | B | C | D | E | F | G | | | | | | |
| 71 | LS-95 | E.E.R 02 ( A ) PIPE FLANGE JOINT WATER LEAK L.H | L A H | 1 | DX007S-1FT | 360 | - | - | - | 260 | - | 100 | 5K100A | 1 | 15C | 56 | - | |
| 72 | LS-96 | SWBD RM 01 ( F ) FWD PIPE FLANGE JOINT WATER LEAK L.H | L A H | 1 | DX007S-1FT | 360 | - | - | - | 260 | - | 100 | " | 1 | " | " | - | |
| 73 | LS-97 | SWBD RM 01 ( A ) AFT PIPE FLANGE JOINT WATER LEAK L.H | L A H | 1 | DX007S-1FT | 360 | - | - | - | 260 | - | 100 | " | 1 | " | " | - | |
| 74 | LS-98 | E.E.R 01 ( P ) PIPE FLANGE JOINT WATER LEAK L.H | L A H | 1 | DX007S-1FT | 360 | - | - | - | 260 | - | 100 | " | 1 | " | " | - | |
| 75 | LS-99 | E.E.R 02 ( S ) PIPE FLANGE JOINT WATER LEAK L.H | L A H | 1 | DX007S-1FT | 360 | - | - | - | 260 | - | 100 | " | 1 | " | " | - | |
| 76 | LS-103 | 900T CRANE SWBD ROOM VOID SPACE BILGE L.H | L A H | 1 | DX007S-1FT | 1500 | - | - | - | 1400 | - | 100 | " | 1 | " | " | - | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

**Contact Capacity**

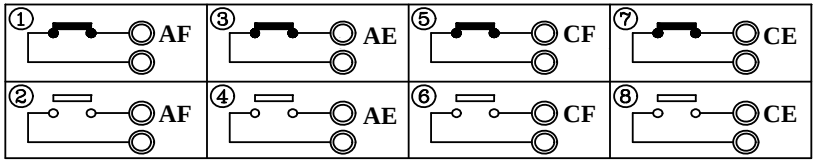
50VA
AC 250V 1A
AC 110V 2.27A
DC 24V 5.2A

**Contact Composition**

**A F :** High Level Alarm
**A E :** Low Level Alarm
**C F :** High Level Control
**C E :** Low Level Control

**Contact**

· B (Normally Closed) →
· A (Normally Open) →




※This drawing indicates normal conditions (At the point of alarm or control, contacts turn the contrary).

# Spec. Table for Level Switch

**Ship No. : HN2649**

**UTS 67** (Ultrasonic Level Switch)

| No. | Tag No. (Channel) | Tank Name | Remarks Alrm/C'trol | Q'ty | Dwg. No. | Dimension(mm) A | Flange | Contact Comp. (Current Output) | Cable Gland | I P | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *1* | WD-01 | CABLE / PIPE TRUNK ( P ) WATER DETECTION | L A H | 1 | DX014-UTS-U01 | 115 | PF 1" | 7±1mA / 14±1mA | PG13 | 67 | WITH WELDING BRACKET |
| *2* | WD-02 | CABLE / PIPE TRUNK ( P ) WATER DETECTION | L A H | 1 | DX014-UTS-U01 | 115 | " | 7±1mA / 14±1mA | " | " | " |
| *3* | WD-03 | CABLE / PIPE TRUNK ( S ) WATER DETECTION | L A H | 1 | DX014-UTS-U01 | 115 | " | 7±1mA / 14±1mA | " | " | " |
| *4* | WD-04 | CABLE / PIPE TRUNK ( S ) WATER DETECTION | L A H | 1 | DX014-UTS-U01 | 115 | " | 7±1mA / 14±1mA | " | " | " |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

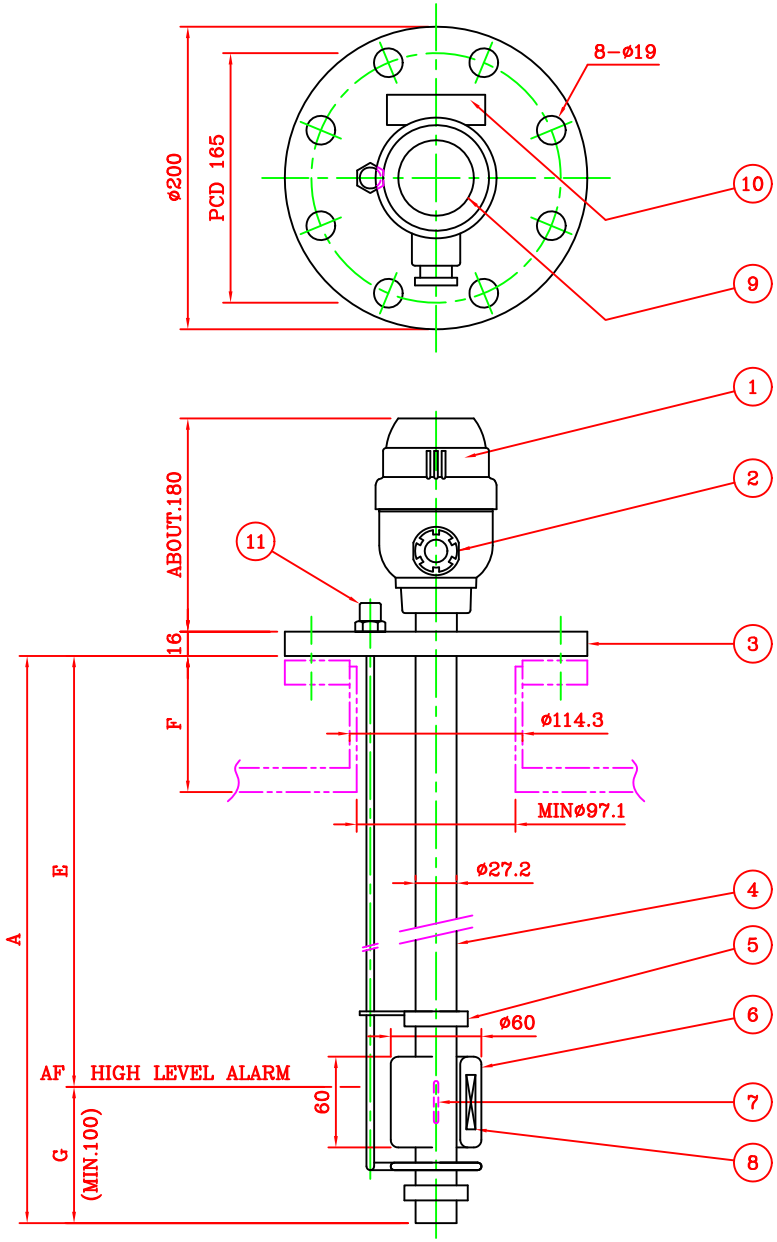
**Remark ( Alrm / C'trol )**

**LAHH :** High-High Level Alarm **LAH** : High Level Alarm LCH : High Level Control **LAL** : Low Level Control **LCL** : Low Level Control

**Contact Comp. ( Current Output )**

Dry Condition : **7±1mA** Wet Condition : **14±1mA**

**DAEHWA ENGINEERING SENSOR CO., LTD.**

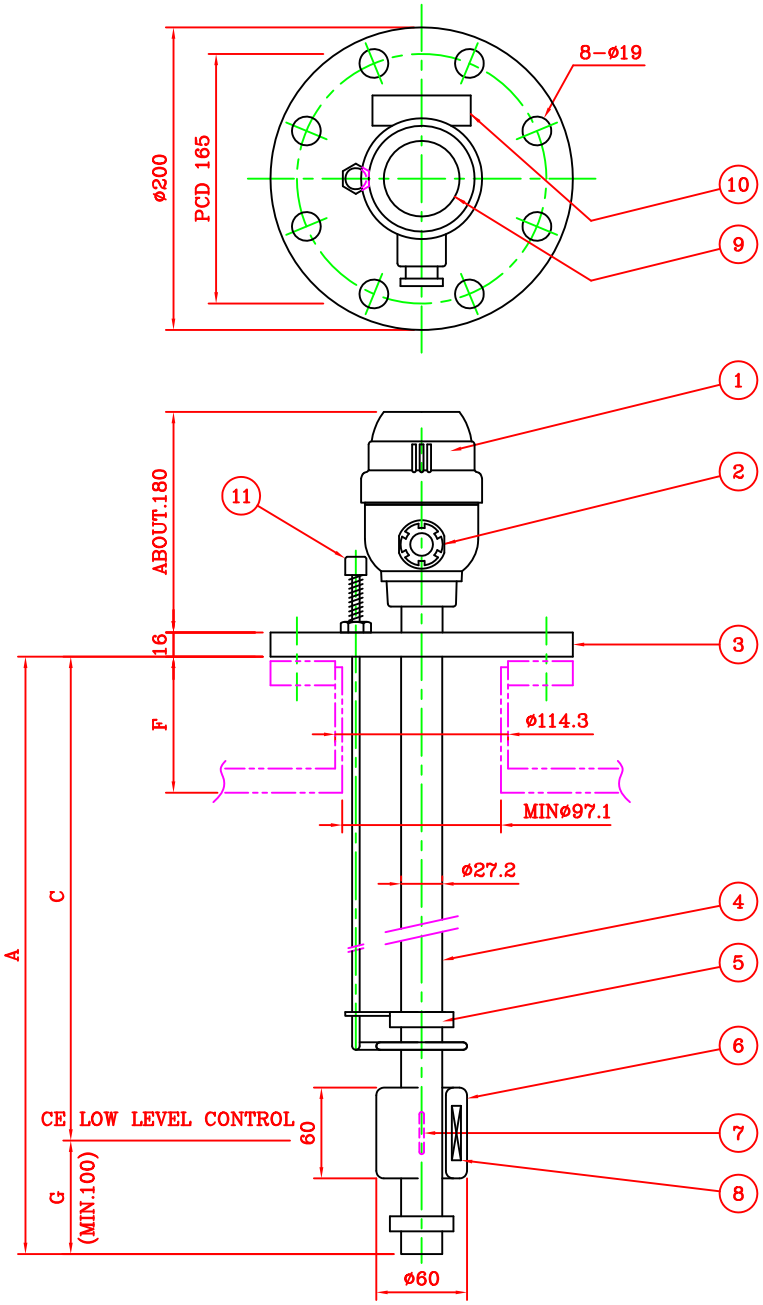



| NO. | PART NAME | MAT'L | Q'TY | REM'S |
|---|---|---|---|---|
| 11 | TESTING DEVICE | SUS304 BsBM | 1 | |
| 10 | USE NAME PLATE | SUS304 | 1 | |
| 9 | NAME PLATE | TETRON FILM | 1 | |
| 8 | MAGNET | | 1 SET | |
| 7 | REED SWITCH | | 1 SET | 50VA |
| 6 | FLOAT | SYNTHETIC RUBBER | 1 | |
| 5 | FLOAT STOPPER | SUS304 | 2 | |
| 4 | GUIDE PIPE | SUS304 | 1 | |
| 3 | FLANGE | SS400 | 1 | JIS 5K 100A |
| 2 | CABLE GLAND | AC BsBM | 1 | |
| 1 | TERMINAL BOX | AC | 1 | |

| REV. | DESCRIPTION | DATE | CHK. | APP. |
|---|---|---|---|---|

SPEC.
TYPE : LS-TM-1FT-100A
CONTACT CAP. : 50VA
MAX. TEMP. : 80°C
ENCLOSURE : IP56

| | | | |
|---|---|---|---|
| WT. | SCALE | 1/5 | DATE SEP. 2005 |
| | DWG. | DSG. | CHK. APP. |
| DWG. SZ. A4 | TITLE | LEVEL SWITCH | |
| DAEHWA ENGINEERING | DWG.NO. | DX007S-1FT | |

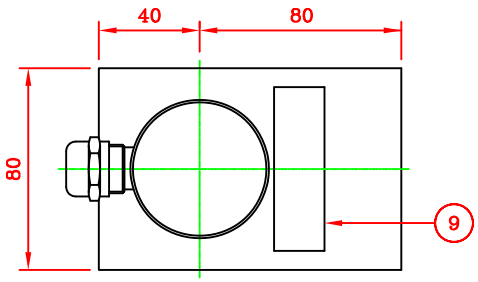


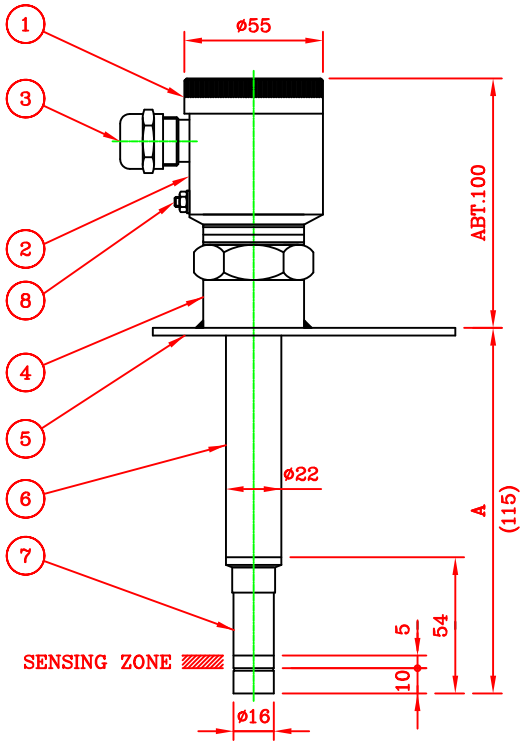

| NO. | PART NAME | MAT'L | Q'TY | REM'S |
|---|---|---|---|---|
| 11 | TESTING DEVICE | SUS304 BsBM | 1 | |
| 10 | USE NAME PLATE | SUS304 | 1 | |
| 9 | NAME PLATE | TETRON FILM | 1 | |
| 8 | MAGNET | | 1 SET | |
| 7 | REED SWITCH | | 1 SET | 50VA |
| 6 | FLOAT | SYNTHETIC RUBBER | 1 | |
| 5 | FLOAT STOPPER | SUS304 | 2 | |
| 4 | GUIDE PIPE | SUS304 | 1 | |
| 3 | FLANGE | SS400 | 1 | JIS 5K 100A |
| 2 | CABLE GLAND | AC BsBM | 1 | |
| 1 | TERMINAL BOX | AC | 1 | |

| REV. | DESCRIPTION | DATE | CHK. | APP. |
|---|---|---|---|---|

SPEC.
TYPE : LS-TM-1FT-100A
CONTACT CAP. : 50VA
MAX. TEMP. : 120°C
ENCLOSURE : IP56

| | | | |
|---|---|---|---|
| WT. | SCALE | 1/5 | DATE SEP. 2005 |
| | DWG. | DSG. | CHK. APP. |
| DWG. SZ. | A4 | TITLE | LEVEL SWITCH |
| DAEHWA ENGINEERING | | DWG.NO. | DX007S-1FT-3 |

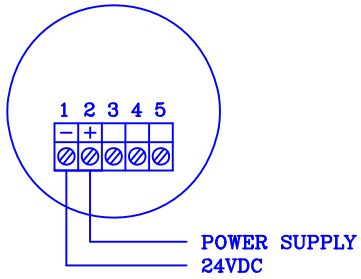



## ■ TECHNICAL SPECIFICATION

1. OUTPUT SIGNAL : DRY CONDITION – 7±1mA
   WET CONDITION – 14±1mA
2. POWER SUPPLY : 24VDC +20%/–25% DIRECT–CURRENT
3. MAX. PERMISSIBLR RESISTANCE
   IN SUPPLY CIRCUIT AT 24VDC : LESS THAN 720 Ohm
4. POWER CONSUMPTION : LESS THAN 0.5W
5. AMBIENT OPERATION TEMP. : –50°C TO +85°C
6. PRODUCT TEMP. : –55°C TO +100°C
7. WORKING PRESS. : SPECIAL VERSION UP TO 400bar
8. PROTECTION RATE : IP67
9. APPROVAL : CLASS DNV, GL, BV, ABS, RMRS

## ■ WIRING DIAGRAM




⑨ USE NAME PLATE (EXAMPLE)


| NO. | PART NAME | MAT'L | Q'TY | REM'S |
|---|---|---|---|---|
| 9 | USE NAME PLATE | SUS304 | 1 | |
| 8 | EARTH BOLT | ASNI 316L | 1 | M4 |
| 7 | WAVE GUIDE | ASNI 316L | 1 | |
| 6 | EXTENDER | ASNI 316L | 1 | |
| 5 | PLATE | SUS304 | 1 | |
| 4 | SOCKET | SUS304 | 1 | |
| 3 | CABLE GLAND | ASNI 316L | 1 | PG13 |
| 2 | HOUSING | ASNI 316L | 1 | |
| 1 | COVER | ASNI 316L | 1 | |

| REV. | DESCRIPTION | DATE | CHK. | APP. |
|---|---|---|---|---|

SPEC.
TYPE : UTS 67

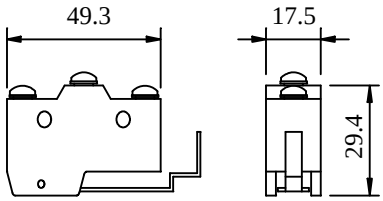
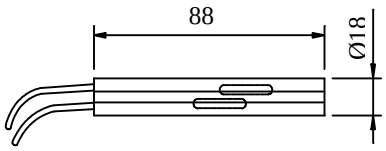
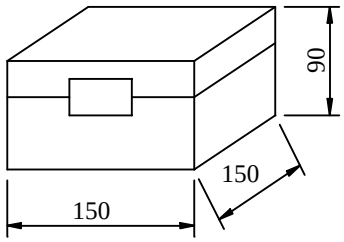
| | | | |
|---|---|---|---|
| WT. | SCALE | 1/4 | DATE MAR. 2000 |
| | DWG. | DSG. | CHK. APP. |
| DWG. SZ. | A4 | TITLE | ULTRASONIC LEVEL SWITCH |

DAEHWA ENGINEERING

DWG.NO. DX014–UTS–U01

# Spare Parts List

**Ship No. : H2649**

| Item No. | Part Name | Outline | Quantuty | | Remarks |
|---|---|---|---|---|---|
| | | | Working per Vssl | Spare per Vssl | |
| 1 | MICRO SWITCH |  | - | 1 | Z-15GW-B<br>Z4G1L01B 675008<br>15A 125, 250 or 480VAC |
| 2 | SENSOR<br>( Reed Switch<br>Molded In ) |  | - | 6 | NEC RD24E<br>40-50AT |
| 3 | SPARE BOX |  | - | 1 | POLYCARBONATE<br>& ABS-V-O |
| | | | | | |
| | | | | | |
| | | | | | |

# INSTRUCTION MANUAL

FOR

## LEVEL SWITCH

**( TYPE : LS-SM / LS-TM )**

DAEHWA Engineering Sensor Co., Ltd.

## 1. Cautions in Handling.

### 1) Detector & Level Switch.

- Do not bend the guide pipe of the detector ( Stainless Pipe ) by giving external force. The inside of pipe has a built-in detecting element.
- At the time of connection of detector, or when parts are replaced, repaired, checked or maintained, be sure to do it after turning off the power switch.
- Detector shall be connected as shown in connection diagram.
  - If the power switch is turned on with mis-wiring, the reed switch will be seized or the integrated circuit will be burnt damaged.

### 2) Power Supply & Control Block. ( Including Indicator )

- At the time of connection of power supply and control block, or when parts are replaced, repaired, checked or maintained, be sure to do so after turning off the power switch.
- Power supply and control block shall be connected as shown in connection diagram.
  - If the power switch is turned on with mis-wiring, the reed switch will be seized or the integrated circuit will be burnt damaged.
- In the case of cleaning, do not touch the conductor with a piece of wet cloth.

### 3) Others.

- At the time of connection, be sure to tighten screws, etc.
- Gland, Flange, etc. of wire penetrating part and cover included.

- With the power switches of the power supply and control turned on, do not connect or disconnect the wire terminal connected with the detector.
- There is a possibility that use of transceiver will cause a radio wave interference. Therefore, if a transceiver is used, use it apart 1 meter and more from the liquid level gauge.

## 1. Maintenance of Liquid Level Switch.

1) Inspection and Maintenance table.

| Maintenance Position | Procedure for Inspection / Maintenance | Remedy / Countermeasure | Time |
|---|---|---|---|
| Level Switch | 1. Check whether or not there is no damage of cable gland not loosening. | 1. Exchange of damaged. | At the time of restarting of use and every 6 months. |
| | 2. Check whether or not there is no loosening in the terminal part. (wiring etc.) | 2. Re-tighten. | |
| | 3. Check the terminal box. | 3. Check whether or not sea water enters it. | |
| | 4. Check whether or not the float has been corroded, damaged or worn. (Especially, check the inside and weld well.) | 4. If there is anything which has been corroded, damaged or worn, exchange of for a new one. | |
| | 5. Check whether or not the guide pope has been corroded and damaged. | 5. If there is anything which has been corroded, damaged, exchange it for a new one. | |
| | 6. Check whether or not there is a surface roughening due to rusting on the flanged surface. (welded surface.) | 6. Clean it. | |
| | 7. Check whether or not there is no loosening of tightening screw not resting. | 7. Re-tighten and clean it. | |

| Maintenance Position | Procedure for Inspection / Maintenance | Remedy / Countermeasure | Time |
|---|---|---|---|
| Level Switch | 8. Check whether or not there is no crack or marked deformation in packings and others. | 9. Exchange if required. | At the time of restarting of use and every 6 months. |
| | 9. Check whether or not there are stains deposited between float and guide pipe and inside the protective pipe. | 10. Remove stains. | |

| Maintenance Position | Procedure for Inspection / Maintenance | Remedy / Countermeasure | Time |
|---|---|---|---|
| Power Supply & Control Block (Including Indicator) | 1. Check whether or not there is no stains at the power supply and control block. | 1. Clean it. | At the time of restarting of use and every 6 months. |
| | 2. Check whether or not there is no loosening of tightening screws and resting. | 2. Re-tighten and clean it. | |
| | 3. Check whether or not there is any loosening of terminal blocks. (Wiring etc.) | 3. Re-tighten. | |
| | 4. Check the related parts of the power supply and control. | 4. If there is any part which has been chipped, burnt damaged or corroded, replace it with a new one. | |
| | 5. Check whether or not there is any damage or stain at the display | 5. Exchange and/or repair the defective parts. And clean up the dirtiness. | |

| Maintenance Position | Procedure for Inspection / Maintenance | Remedy / Countermeasure | Time |
|---|---|---|---|
| Power Supply & Control Block (Including Indicator) | 6. Confirmation on the action of alarm and display.<br>※ Confirm it, referring to the operation manual. | 6. If the malfunction is existed, check initial set-up's operation will be tried again. | At the time of restarting of use and every 6 months. |
| | | | |
| | | | |
| | | | |
| | | | |

## 1. Trouble Shooting.

- If you have a reason to believe that the level switch is not functioning properly, the "SYMPTOMS", " POSSIBLE CAUSES" and "CORRECTIVE MEASURES" are collected in table form.

Please take appropriate action after informing us of the circumstances.

| Symptoms | Possible Causes | Corrective Measures |
|---|---|---|
| The power lamp fails to work on turning on the power. | An oversupply of power has caused a blown fuse | After ensuring there is no damage to part in the control box, exchange it for a spare fuse. |
| The alarm lamp fails to work on. | The float is stuck. | After ascertaining the reason for sticking, take appropriate action. |
| | The lamp is broken. | Replace the lamp with a spare. |
| | The printed circuit board is troubled. | Replace the printed circuit board with a spare. |
| The alarm lamp fails to work correctly. | The reed switch is not working. | Replace the broken reed switch. |
| | The sensor is not properly insulated. | After ascertaining the reason for the lack of insulation, remove moisture from inside the detector and sensor. |

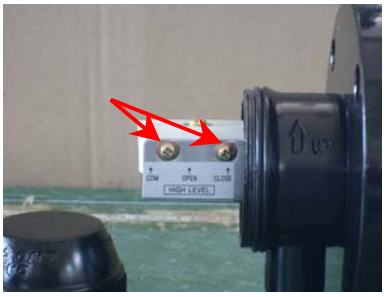
# 1. Replacement Method of Defective Parts.

## 1) Type : LS-SM

### 1) Part Name : Float Ass'y

| 1. Open the switch box cover and then remove cables on the micro switch. | 2. Separate the level switch from the tank. |
|---|---|
|  |  |
| 2. Remove a split pin. | 3. Separate a float shaft. |
|  |  |
| 4. Remove defective a float+arm. | 5. Replace defective float+arm with new one. And, please reassemble level switch. |
|  |  |

### 2) Part Name : Micro switch

| 1. Open the switch box cover and then remove cables on the micro switch. | 2. Separate 2-bolts. |
|---|---|
|  |  |
| 3. Remove defective a micro switch. | 4. Replace defective micro switch with new one. And, please reassemble level switch. |
|  |  |

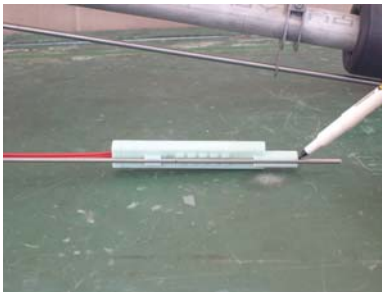
⚠ **This replacement work don't have to separate the level switch from the tank.**

## 2) Type : LS-TM

### 1) Part Name : Float

| 1. Open the terminal box cover and then remove cables on the terminal block. | 2. Separate the level switch from the tank. |
|---|---|
|  |  |
| 3. Separate a handle of test device. | 4. Separate a test device. |
|  |  |
| 5. Remove defective a float. | 5. Replace defective float with new one. And, please reassemble level switch. |
|  |  |

### 2) Part Name : Sensor

| 1. Open the terminal box cover and then remove cables on the terminal block. | 2. Separate 2-bolts. |
|---|---|
|  |  |
| 3. Separate terminal block and sensor from level switch. | 4. Mark the position of sensor attached on the round bar. |
|  |  |
| 5. Remove defective sensor and cables. | 6. Replace defective sensor and cables with new one. And, please reassemble level switch. |
|  |  |

⚠ **This replacement work don't have to separate the level switch from the tank.**

 **If water permeated inside the guide pipe, you should replace the sensor after entirely remove water and dry the guide pipe.**

# INSTRUCTION MANUAL

FOR

## ACOUSTIC WAVE SWITCH

**( TYPE : UTS 67 )**

DAEHWA Engineering Sensor Co., Ltd.

# UTS and TLA series
# of
# Ultrasonic level switches

## Operation Manual



API Marine ApS. - Troensevej 12 - DK-9220 Aalborg Oest – Denmark. Tel.: +45 96345070 – Fax: +45 96340170

# 1 INTRODUCTION:

This manual does not include information concerning all type of equipments and/or all possible working and mounting solutions. For more information or for particular subjects not described in this manual, please contact the company. For the warranty period please see our general terms of sales and delivery. This warranty is neither increased nor restricted by the contents of this manual.

ATTENTION!

- This sensor has to be installed and used only by qualified persons who first have checked the correctness of the supply voltage, so that both in standard working conditions and in presence of fault conditions in the supply or of any part of it, no dangerous voltage can reach the sensor.
- As the sensor can be utilized both with high pressure values and with aggressive media it must be considered that an incorrect use of it could bring even serious damages to persons and things.
- Correct and safe working needs an adequate transport, stock, mounting and last but not least an appropriate maintenance service.
- So it is necessary for the persons handling these apparatus to have:
    - Knowledge and experience in mounting, servicing, operating and to have commitment to do their job with reference to “Safety Standards“.

API Marine could modify this document in any moment without previous advice.



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# 2 Document history

| Rev. | Date. | Remark |
|---|---|---|
| 001 | 08-09-2005 | Original |
| 002 | 01-11-2005 | Product temp. removed. |
| 003 | 02-11-2005 | 10.6 Flexible extenders removed. |
| 004 | 31-01-2006 | 14. Ordering codes adjusted. |
| 005 | 10-02-2006 | |
| 006 | 16-02-2006 | 7 Relay output text changed. |
| 007 | 27-03-2007 | Editorial corrections, drawings. |
| 008 | 23-05-2008 | ASL 500 renamed to UTS. Editorial corrections. |

## Index.






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MODELS COVERED.
The following API Marine UTS series switches are covered by this manual.
Model UTS with single probe.
Model TLA with double probe.

**NOTE:**
For ATEX version sensors, the guidelines included in this manual should be integrated with the guidelines included in safety instructions manual for the product.

# 3 Field of application

***UTS level sensors*** are designed to be used as sensors in alarm systems, automatic process control, and liquid detection systems and in other systems, in which a definite liquid level control is required.
***Sensors*** are used on liquids in density range from 0,3 gr/cm$^3$ (water, oil, petroleum, mineral oil products, acids, alkali, etc.).
***Sensors*** can be mounted on reservoirs, pipelines and other units, at any position indoors and outdoors in wide range of environmental conditions. Sensors can be installed on fixed units as well as on moving ones regardless of vibration. The sensors have no moving parts, they are shock resistant, need no adjustments and minimal maintenance works during its operating time.
***Sensors*** can be installed both in standard and in dangerously explosive facilities in accordance with standard-technical documents, which regulate the use of electrical equipment in explosive zones.

# 4 Principle of operation

Principle of sensor's operation is based on an ultrasonic wave transmission in metal rod. On the one end of a cylindrical metal rod (waveguide) a piezoelectric transducer is mounted; it transmits impulses, which moves along the waveguide as an acoustic waves. Under their force, a sensitive zone located on the opposite end of the rod starts to oscillate. Oscillations from the sensitive zone transmit a reflected wave back to the transducer, which transforms the wave into electric signal.
If the sensitive zone is immerged in a liquid, the energy of its oscillations is absorbed in the liquid. Therefore, the oscillation will decrease significantly. If the sensitive zone is placed in air (in a gas phase, in steams etc.), the oscillation energy from waveguide does not decrease because of the great difference of the specific acoustic impedance on the junction between metal and air. Thus, oscillations are only damped slightly.
The electric signal from the transducer is send to an electronic module, which converts the input signal to a corresponding output signal. The same electronic module generates and transmits the impulses.


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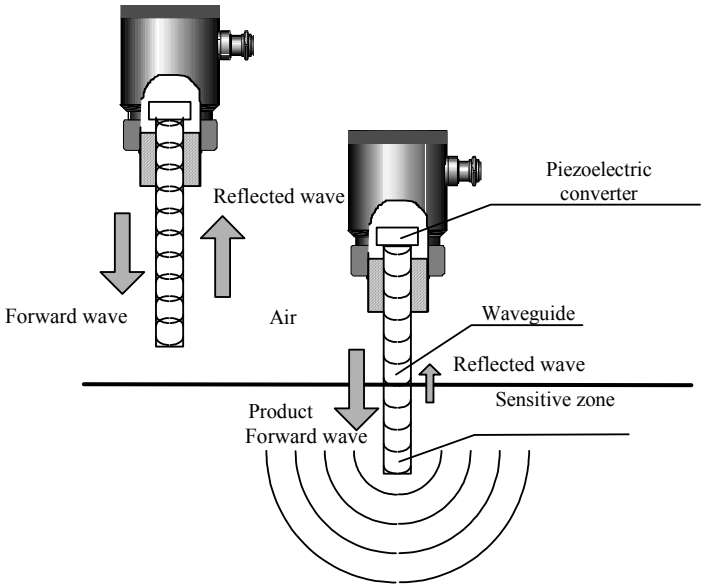
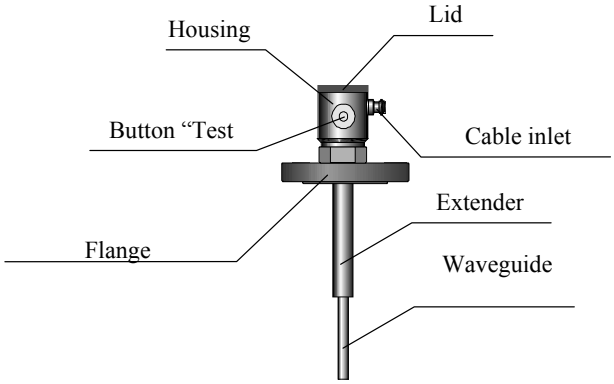



# 5 Construction and principle of operation

UTS level sensor consists of:

- Housing.
- Flange.
- Extender.
- Waveguide with a piezoelectric converter.
- Electronic module.




The sensor housing serves to protect the electronic module from external actions. It has the form of cylindrical container with a top-screwed lid, which is sealed with an O-ring. Opening the lid makes the electronic module assessable and provides access to the system connections. The housing has a side cable inlet sealed by rubber gland seal. On the outer surface of the housing the sensor is a marked with type, serial number, explosion-proof ness and main electric specifications. Depending on version a test button is located on the housing. Activating this button will check if the sensor is intact.



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At the bottom of the housing there is a hex nut (S41) and an external pipe thread to mount sensor to the flange that fit the reservoir mouth. Depending on the application this junction is either welded or sealed with a rubber gasket in a groove. In some versions the thread can be replaced with a flange connector.

At the bottom of the housing an extender is welded on – it is a thin-wall stainless steel pipe; the length of the pipe determines the level of switching. Inside the extender there is a wire connecting the electronic module and piezoelectric converter.

At the bottom of the extender an acoustic waveguide is welded on. On its top end, inside the extender, the piezoelectric transducer is mounted. The sensor's sensitive zone is located about 5mm from the end of the wave guide.

All metal parts of the sensor, which is in contact with the outside air, with the inside atmosphere of the reservoir or with a product, are made of stainless steel ASI 316. All sealing elements are made of oil resistant rubber.

Inside the sensor's housing the electronic module is placed. On the electronic module there is terminal-block with the sensor connections. Electric connection to the piezoelectric transducer is located on the bottom of the module. The electric circuits are intrinsic safe approved. The electronic module has a current output signal in a range 4-20 mA. There are also the versions with relay output.
The electronic module contains a generator. The generator generates electrical impulses which are transmitted via the cable to the piezoelectric transducer. Now the piezoelectric transducer creates sound impulses in the acoustic waveguide. The sound spread from the top end to the bottom. Impulses reflected from the bottom end returns to the piezoelectric converter where they are transformed into an electric signal. This signal is fed to the electronic module. Under the action of impulses the sensitive zone of the waveguide gets driven, therefore, the reflected impulses have a considerable duration. When the liquid surface reaches the sensitive zone, the acoustic oscillations get damped and the duration of the reflected impulses quickly decreases. The electronic module detects this decrease and change its output current from 13 mA to 6. The same current is used to supply the electric circuit of the electronic module.

Actuation of the sensor occurs only when the sensitive zone is in contact with the product. The rest of waveguide surface including its end is not sensitive for liquid; therefore, drops on the sensor do not cause false actuations.



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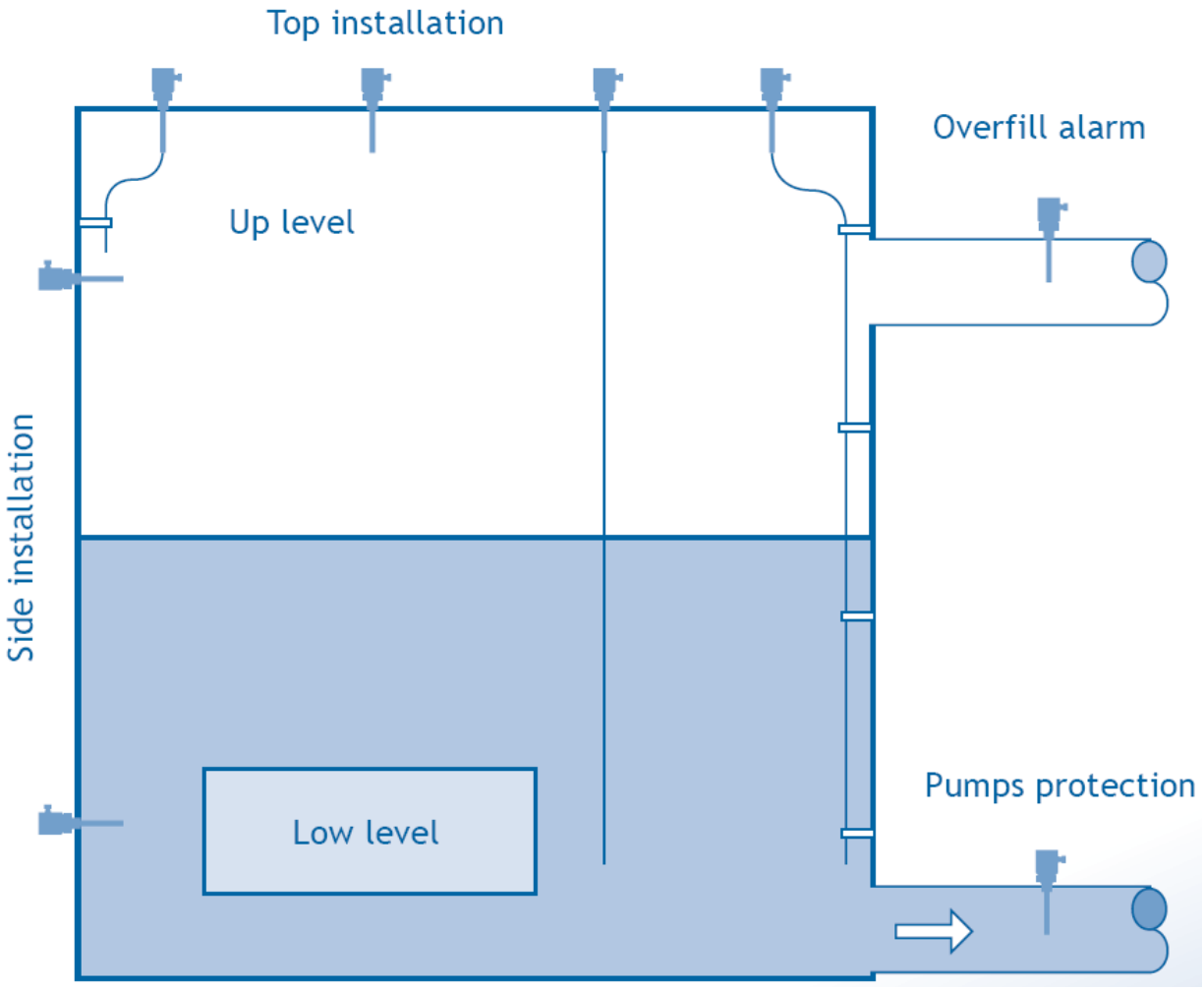
# 6 UTS installations on reservoirs, plants, pipelines, etc.:

The UTS can be installed in various locations such as reservoirs, plants, and pipelines for different purposes as shown below. As there are no moving parts the orientation of the UTS are not important with respect to the function of the sensor, however local conditions e.g. heating from other machine parts, must be noticed.



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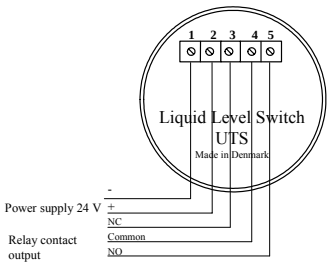
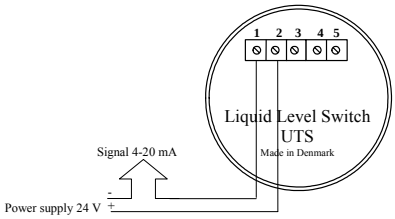
# 7 Connections

## 7.1 Connection UTS

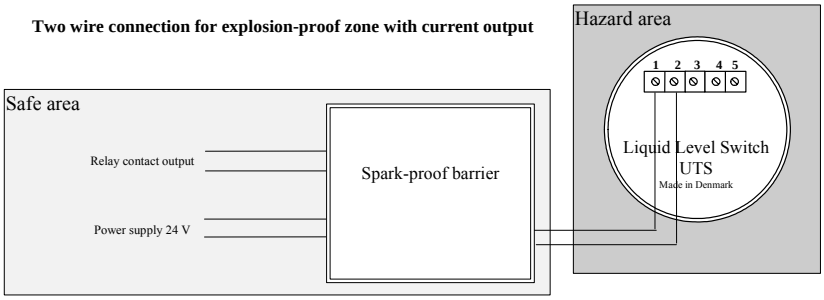
**Four wire connection for NONE hazard area with relay contact output**




**Two wire connection for hazard area with current output**



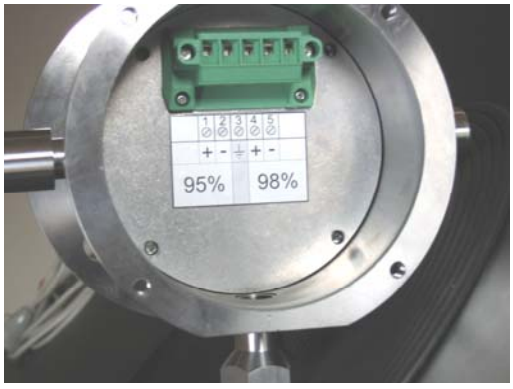

**Two wire connection for explosion-proof zone with current output**

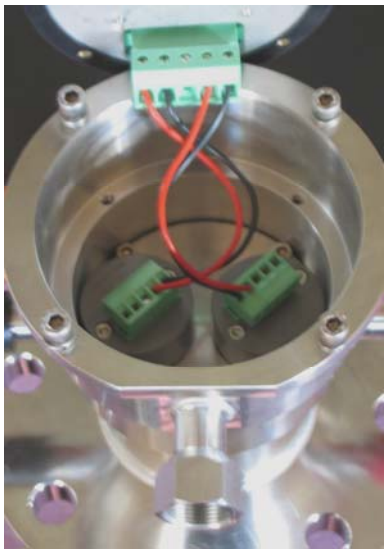



## 7.2 Connection TLA

The electronics of the TLA comprises of two pcs. of electronic module. Both are installed below an intersection plate which has a connector on the top. The label below the connector shows how to connect wires to the TLA

| | Connector No. | |
|---|---|---|
| 95% | 1 | + |
| | 2 | - |
| Ground | 3 | |
| 98% | 4 | + |
| | 5 | - |





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# 8 Technical Specifications

| | | |
|---|---|---|
| •Output signal: | | |
| | a) Current: | 14 ± 1 mA «dry/wet» and 7 ± 1 mA «wet/dry». |
| | b) Solid state relay: | On resistance 15ohm. Off resistance: NO 0.35Gohm, NC 0.1Gohm, current limit 200mA, max. switching voltage 200V. Isolation 3.75KV. |
| •Repetition of actuation level: | | |
| | | Vertical installation: 3 mm |
| | | Horizontal installation: 1 mm |
| •Power supply voltage: | | 24V +20%/-25% direct-current |
| •Maximum permissible resistance in supply circuit at 24V: | | less than 720 Ohm |
| •Power consumption: | | less than 0,5 W |
| •Insulation resistance at~500V: | | not less than 5 GOhm |
| •Ambient operating temperature: | | -40°C to +85 °C (for IS -40°C to +57°C) |
| •Product temperature: | | -200°C to +450 °C |
| •Relative ambient humidity: | | up to 100% at 50°C |
| •Ambient air pressure: | | 600 to 2500 mm of Mercury |
| •Reservoir pressure: | | -500mbar to +500mbar |
| •Response time: | | 1 min. depending on actual programming |
| •Protection rate: | | IP67 |
| •Vibration: | | 4 g. for standard length 115 mm, 1-100 Hz |
| •Constant magnetic field: | | max. 400 A/m |
| •Alternating magnetic field: | | 50 and 400 Hz, max. 80 A/m |
| •MBTF: | | 50000 hrs |
| •MTTR: | | Less than 30 min |

# 9 Versions

## 9.1 Housing type.

**Stainless steel** housing is designed for standard and spark-proof versions of sensors. They ensure an Ingress Protection rate of IP67.
At costumer request other kinds of housings can be used as well.

## 9.2 Fixture type.

Sensors are produced with two types of fixture: screw or flange.
For **screw** fixture the following are availed:

- pipe thread (G1″-A, G1,5″-A, G2″-A),
- taper thread (1″NPT)
- metric thread (M27x1.5).



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For **flange** type standard flanges are used DN25 PN10-16, DN40 PN10-16, and DN50PN10-16. If required, other standard flange or flanged produced by customer's drawings can be used. Besides, for reservoirs without inside pressure in case of upper mounting of the sensor, a moving type of fixture can be used, for which screw sensors are used with one check point. The moving type of fixture allows adjusting of sensor to any level of actuating in a range determined by the length of the rigid part of its extender.

## 9.3 Number of check points.

Sensors are produced with **one** or **two** check points, i.e. the device can be actuated on reaching every of these tank levels. Two check points can be required, for instance, to indicate 95% and 98% of reservoir filling level. Screw fixture G1″, 1″NPT or M27x1.5 are applied only for single sensors, G2″ – only for double sensors, and the rest ones – in both cases.

## 9.4 Cable inlet.

With stainless steel housings three sizes of standard cable inlets are used: PG13,5 cable gland (PG16) , cable inlet with female thread M24x1.5 for adapter to cable protection hose, and M20x1.5 cable inlet for customer specified cable glands (for IS, shall be IP67).

## 9.5 Protection rate.

Stainless steel housings are supplied with Ingress Protection grade of IP67.

## 9.6 Length.

The length of sensor is measured as the distance from the flange joint face (for screw fastening – from the end of thread) to the end of the waveguide. The basic versions of sensor have 115 mm length. In case a sensor with length other than 115 mm, a pipe extension with diameter of 20, 22 or 28 mm is used.
If sensors are to be used in reservoirs with pressure up to 400 bar, use of extenders is impossible, the required length is provided by the waveguide itself, and is limit to max. 1500 mm.

In all cases when the length differs from 115 mm, it shall be specified in the order code, for the TLA sensor both lengths are to be given. While determining the required sensor's length, it should be considered that the sensitive zone is located 15 mm from the waveguide's end.

# 10 Intrinsic safe.

To provide intrinsic safe sensors UTS are produced in two versions: 1) standard (not explosion-proof) 2) intrinsic safe electric circuit and intrinsic safe casing. Both are produced in stainless steel housing. The standard type of sensors has an output of "dry contact" type and uses 4-wire connection.



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The “intrinsic safe electric circuit” type of sensors with “EEx: ia IIC T6 -40<$T_{amb}$<57°C” marking has a current output and uses 2-wire connection. It should be connected via intrinsic safety barrier with EExiaIIC marking, which also serves as a power source and is installed in a safety zone.

## 11 Working pressure.

The standard versions of sensors are produced to be used on reservoirs (pipelines, plants etc.) with the pressure up to 40 bars.

> **NOTE!**
> When TLA has to be used in applications where the product pressure is higher than 1.1bar the version with full welded extensions pipes must be selected.

Besides, there is also a version of sensors for reservoirs with working pressure up to 400 bar without extenders. The required level of actuation is provided with the waveguide’s length, which is limit to max. 1500 mm.

## 12 Product temperature.

For any project the product temperature range shall be considered along with the ambient temperature range. The temperature ranges below are thus only for guidance.

Standard version: -55 to +100°C
Extension one radiator: -104 to +140°C
Extension two radiators: -200 to +450°C
No extended temperature range is available for TLA level switch.

## 13 Corrosion resistance.

All parts of the sensors, which are in contact with a product, are manufactured of a corrosion resistant material (stainless steel, SS316) with respect to the majority of the chemical substances. For operation in chemically active products materials with high corrosion resistance are used (Hastealloy B, C, Monel)

## 14 Order codes

Each sensor has a version code which consists of alphanumerical number; the symbols of the code refer to various parameters. Some parameters can be indicated directly with their value. The full code list to order a definite version is given below.



API Marine ApS. - Troensevej 12 - DK-9220 Aalborg Oest – Denmark. Tel.: +45 96345070 – Fax: +45 96340170

## Order Codes

### Ultrasonic Level Switch - UTS

UTS - ☐☐ - ☐☐☐☐ - ☐☐☐ - ☐☐ - ☐☐☐ - ☐ - ☐ - (☐)

Type of housing

| | |
|---|---|
| Protection level IP67 | 67 |
| Protection level IP68 | 68 |
| Submersible, protection level IP68, cylindrical, with outer diameter 27 mm | M8 |

Length of the switch

| | |
|---|---|
| Minimum length 65mm | 0 0 6 5 |
| Standard length 115mm | 0 1 1 5 |
| Length on request (specify length in mm) | X X XX |

Type and size of connection

| | |
|---|---|
| Metric cylindrical thread M27x1.5 | M 2 7 |
| Pipe cylindrical thread 1 inch | 0 1 G |
| Flange DN 25 PN10-40 | F 2 5 |
| On request | x x x |

Output signal

| | |
|---|---|
| Current 14 mA ("dry")/ 7 mA ("wet") | C 1 |
| Current 7 mA ("dry")/ 14 mA ("wet") | C 2 |
| Namur | N A |
| Dry contact: open ("dry")/closed ("wet") | R 1 |
| Dry contact: closed ("dry")/open ("wet") | R 2 |

Cable input

| | |
|---|---|
| PG13 | P 1 3 |
| M24x1.5 inner | M 2 4 |
| M20x1.5 inner | M 2 0 |
| Special for IP68, specify cable length in meters | x x x |

Temperature range of controlled liquid

| | |
|---|---|
| Standard (-55C - +100C) | L |
| Medium (-104C - +140C) | M |
| Extended (-200C - + 450C) | H |

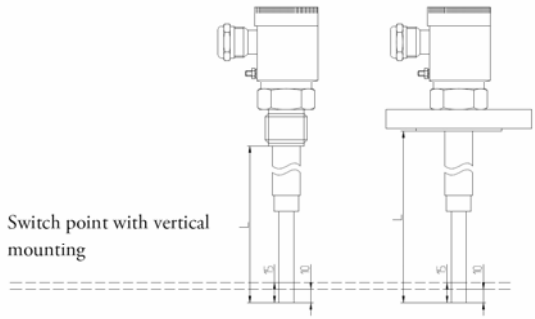
Explosion protection

| | |
|---|---|
| Standard type | N |
| Spark-proof type EEx ia IICT6 | I |

Additional certification - if not needed, this section is left out

| | |
|---|---|
| Det Norske Veritas (DNV) | D |
| Germanischer Lloid (GL) | G |
| Lloyd's Register (LR) | L |
| Bureau Veritas (BV) | B |
| Russian Maritime Register of Shipping (RMRS) | M |
| Russian River Register (RRR) | R |
| other | X |

UTS codes 08.02.08




Pic. 1. Identification of length of the level switch in different connection types



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## Order Codes

### Ultrasonic Level Switch - TLA

TLA - ☐☐☐ - ☐ - ☐☐☐☐ - ☐☐☐☐ - ☐☐ - ( ☐ )

Connection

| | |
|---|---|
| Flange DN 50 PN 10-16 | F 5 0 |
| Other | XXX |

Product pressure

| | |
|---|---|
| standard | 0 |
| pressure more than 0.11 Mpa | 1 |

1st switch point

| | |
|---|---|
| Length of 1st rod in mm L1 | X X X X |

2nd switch point

| | |
|---|---|
| Length of 2nd rod in mm L2 | X X X X |

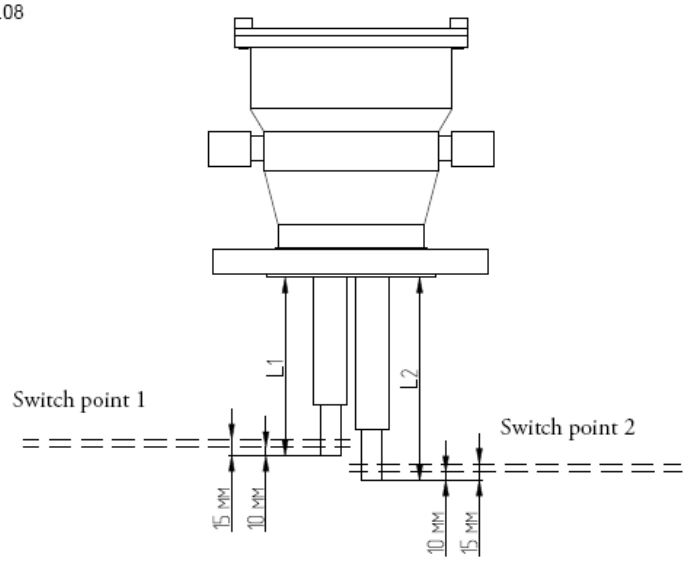
Output signal

| | |
|---|---|
| Current 14 mA ("dry")/ 7 mA ("wet") | C 1 |
| Current 7 mA ("dry")/ 14 mA ("wet") | C 2 |
| Current: upper C1, lower C2 | C 3 |
| Current: upper C2, lower C1 | C 4 |

Additional certification - if not needed, this section is left out

| | |
|---|---|
| Det Norske Veritas (DNV) | D |
| Germanischer Lloyd (GL) | G |
| Lloyd's Register (LR) | L |
| Bureau Veritas (BV) | B |
| Russian Maritime Register of Shipping (RMRS) | M |
| American Bureau of Shipping (ABS) | U |
| Registro Italiana Navale (RINA) | I |
| Russian River Register (RRR) | R |
| other | X |

TLA codes 08.02.08



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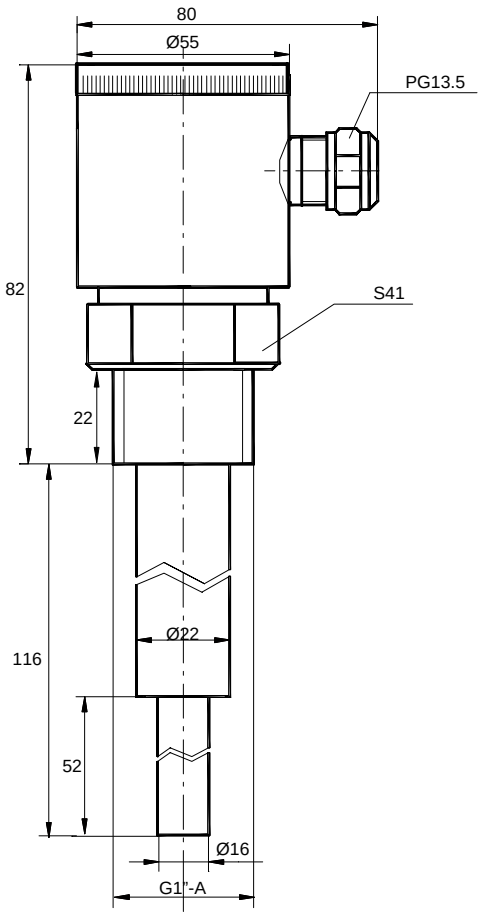
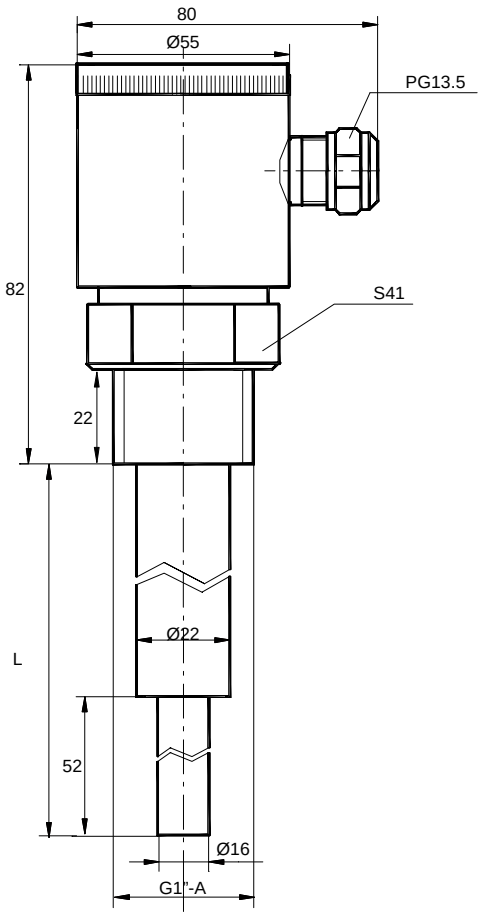
# 15 Outline drawing

## 15.1 Fixture and outline sizes of UTS/TLA level sensors.

Standard fixture versions see the outline drawings. If required fixture and outline sizes can be edited by agreement with a customer, for this purpose a unique drawing is made.




UTS level sensor, standard version.




UTS level sensor with a rigid extender.



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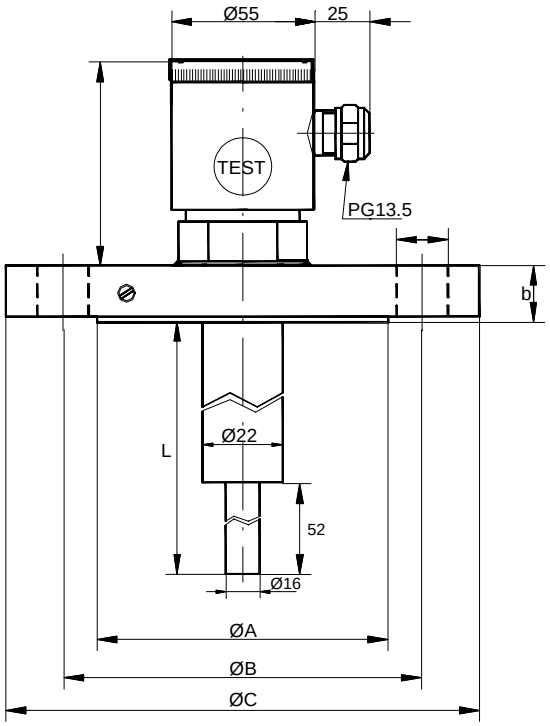
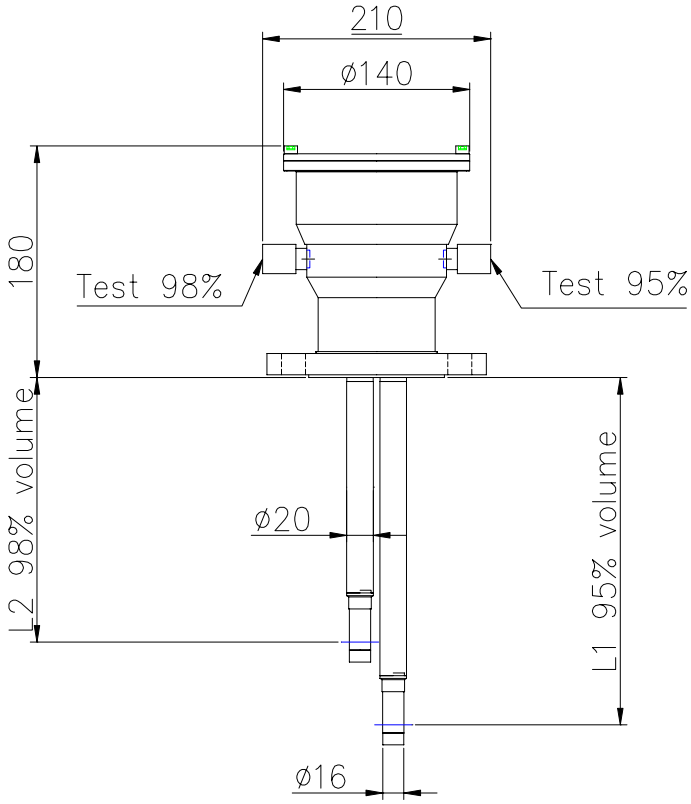



UTS level sensor with flange fixture.




TLA level sensor with DN50 flange.



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# 16 Calibration.

UTS and TLA series of level switches does not need any calibration after installation.

# 17 Maintenance.

UTS and TLA series of level switches does not need any maintenance other than normal inspection of the sensor exterior and cable inlets. Keep the sensor surface clean and all fastenings well tightened.

# 18 Checking and troubleshooting.

Check that the voltage between the + and – terminal is with-in the specified value.
Check the current for “wet/dry” is 7± 1 mA.
Check the current for “dry/wet” is 14 ± 1 mA.
Check that the waveguide is not damaged and without products deposits.



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# DAEHWA Engineering Sensor Co., ltd.

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