USER AND MENTANENCE MANUAL

OF

Plc Controlled Autoclave Pressure Tester (A2101)

CUSTOMER: NEST GROUP

Document Prepared and Published By

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www. neometrixgroup.com

CONTENTS

1. Packing List

The Supply consists of:

Pack- 1 : PLC Controlled Autoclave Pressure Tester

Pack- 2 : Document Basket containing User Manual (Factory test certificate, Calibration Certificates, Hydro Test Certificates for Autoclave chamber, & Catalogs).

Pack -3 : Tools and spare.

2. Do's & Don'ts List (Reference Circuit Diagram)

Autoclave Pressure Tester is a High Pressure system and requires handling by trained personnel. Kindly go through the User Manual in detail before operating the equipment.

➢ Do's

1. Before starting the filling make sure that return line port of Autoclave chamber must be connected with required outlet with hose.
2. Autoclave chamber cover should be properly closed.
3. Make sure that air vent port of autoclave chamber is in open position.
4. Always use clean working fluid ISOPAR M.
5. Make sure air is vented from line and autoclave chamber during filling operation.

➢ Don'ts

1. Don't open the doors during pressurization of system.
2. Don't open autoclave chamber or any other part while system is pressurized.
3. Don't fill the fluid tank above recommended level.
4. Don't pressurize the system above 200 bars.

3. Autoclave Pressure Tester Technical Specifications

Autoclave Pressure Tester Specifications		
S.no.	**Name of Characteristic**	**Value of Characteristic**
1	No of unit tested at a time	12 Nos
2	Autoclave chamber volume	13 liters Approx.
3	Air drive pressure required (In customer scope)	7 bar, Moisture free clean air
4	Safety relief valve setting filling line	5 bar
5	Safety relief valve setting autoclave chamber line	200 bar
6	Check valve cracking pressure	5 psi
7	Purity of Inlet Gas	40 Micron
8	Output Pressure Range	Up to 200 bar
9	Working Media	ISOPAR M
10	Movement Control of system	Portable on 4 caster wheels and single phase Electrical connection
11	Dimension of system (L x W x H)	1800 mm x 1000 mm x 2250 mm
12	Wt. of trolley with empty cylinder	Less than 800 kg

4. System detail, operation sequences & Control Philosophy

Autoclave pressure Tester system has following Sub system:

1) **Air Drive System:** Air Drive System has One Manual Drive air Open /Close Valve (1.0), one filter-Regulator (2.0), filter-Regulator is a combination of Filter & Regulator. Filter- regulator is used for filtration and regulation of Incoming drive air. This clean & regulated drive air is used for Controlling Intensifier (21.0) During Testing and also automatic opening / closing of control valve (28.0 &27.0) using solenoid valve (7.1 , 7.2 &7.3) . By Using Electronic pressure regulator (4.0) we will control Intensifier (24.0) operation. We use manual regulator (34.0) , Electronic pressure regulator (35.0) and 3/2 solenoid valve (33.0) to control air operated high pressure liquid pump (22.0) .We are using pressure gauge (3.0) & Pressure transmitter (5.0) to monitor air pressure. Safety relief Valve (6.0) is used to ensure Intensifier Cannot Pressurized the chamber beyond its working Pressure. We check valve (36.0) at Air Line.

2) **Hydraulic system (Working Fluid ISOPAR)**: It consists of 50 liters S.S. Tank (8.0), Level Indicator (10.0) which will indicate working media level in tank. Filler Breather (9.0) is used for filling of working media in tank, Drain Valve (13.0) is used for Main tank (8.0) drain operation, Suction strainer (14.0) is used to filter working media at filling pump (17.0) suction, Manual Ball Valve With Limit Switch (15.0) is used at Filling Pump (16) Suction, Manual Ball Valve (32.0) is used at high pressure Pump (22.0) Suction. Automatic Control Valve (27.0 & 28.0), Check valve (20.1 to 20.2, 19.0) is used to control the desire Function during Filling, Pressurization & Depressurization of system. Safety relief valve (23.0) is used to protect the system from over pressurization. We are using filter (18.0 & 29.0) for

cleanliness of hydraulic system. We are Monitoring pressure using Pressure gauge(24.0) & Pressure transmitter (25.0)

3) **Autoclave Chamber:** High Pressure Autoclave Testing chamber (26.0) (Design at 200 bar) is used for storage of Unit under test for pressurization up to 150 bar. Internal Diameter of Autoclave Chamber is Approx. 177 mm & Height Approx. 510 mm to accommodate 12 UUT at a time.

4) **Electrical & Electronic System:** We will use Three Phase Motor (17.0) to run the Filling Pump (16.0) at 1500 rpm. We are Using PLC to Control Different Operation like Start of Filling Pump, Controlling of Pressure Intensifier (26.0) and high pressure pump Operation by Using Pressure Transmitter (25.0 & 5.0) Data & by Providing Control Signal to Electronic pressure regulator (4.0 & 35.0). PLC Will Continuously Collect Pressure Data With Respect to Time During Testing & Generate Pressure Vs. Time Graph. We are Using Low Level Switch (11.0) to Stop Motor While Liquid Level Goes down during Filling Operation (Just to Protect Pump from dry operation). We are Using Temperature Transmitter (12.0, 31.0) to Read the Liquid temperature during testing. We are using a Junction Box for Electrical System.

Operation Sequence

Step I: Initially Put Unit under Test inside Autoclave Chamber manually and close the chamber.

Step II: Connect Hoses On autoclave Chamber.

Step III: Start PLC and Insert UUT Detail and go for Filling Operation.

Step IV: When operator will press the filling button on HMI Screen filling pump will be automatically start filling the chamber. Vent the air inside chamber using vent port on autoclave chamber once chamber is filled with working media. Then operator will stop the filling operation using button on HMI Screen.

Step V: Now go for self test of autoclave chamber using step pressurization in zero to five steps from minimum to max. Test pressure range. User can customize no of step, test time and test pressure range.

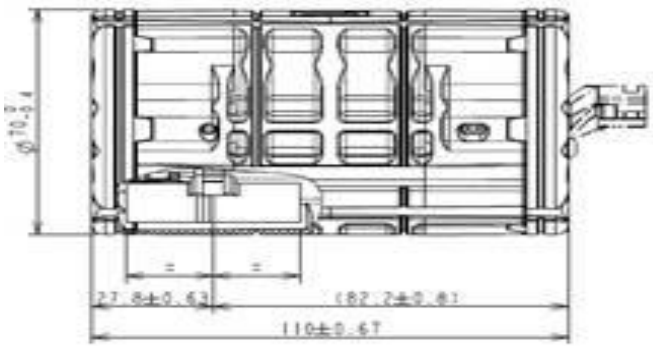
Step VI: Now go for Pressure cycle test. Insert No of cycle, Pressurization Time and other details. Then press start test button on PLC. System will automatically stop after test completion & Graph will be generated.

Step VII: Now go for Drain operation start drain, system will automatically stop after drain operation is completed.

Control Philosophy

Requirements: We want to test Some Electrical Components Which Dimension and testing parameters are as follows:

- Dimension of Material is as follows: Dia: 70mm & Length: 110 mm)



- Working Media: ISOPAR M or L.
- Test Pressure: 150 Bar.
- No of unit to be tested: 12 No's at a time.
- Internal Volume of test Chamber : Internal Height : 510mm , Internal Dia : 177mm
- Pressurizing & Depressurizing Time: Minimum: 5 Min & Max 15 Min.
- No of Cycle: 0-9 No's or More.

Operation:

We are Using High Pressure Autoclave Chamber (26.0) for Pressurization of UUT. Chamber Internal Diameter is 177 mm & Internal Height is 510 mm. It is designed for Working Pressure Up to 200 Bar.

Step I: Filling Operation

First of all we will put UUT inside Autoclave Chamber & we will Properly Close it's Top cover Than We will Power on the HMI System and go for filling operation.

During Filling Operation Pump (16.0) Will Start by Giving Signal to Motor (17.0) from PLC and fill the chamber, During Filling Valve (28.0) will be in open condition & Valve (27.0) is in Close Condition there is some interlocking in this operation which insures pump will start Only When:

1) User will give input that Autoclave chamber 26.0) is Properly Closed, Air Supply is Available for valve operation.
2) Tank (8.0) Level is above Lower Limit. PLC will get feedback signal from low level switch (11.0)
3) Manual Ball Valve with Limit Switch (15.0, 32.0) should be in Open Condition, PLC will take Input from Limit Switch above valve to Insure if it is open or close.
4) Working Fluid temperature is within working range. For this operation PLC will get temperature reading from Temperature transmitter (12.0 ,31.0).
5) Automatic Valve (28.0) is in Open Condition & Valve (27.0) is in closed condition. For this operation PLC will get signal from Solenoid valves (7.1 & 7.2) Position.
6) Filter (18.0) & (29.0) is not clogged.

During filling operation we will run Pump (16.0) two times first time fill the chamber and stop the filling pump for two minute and again run the filling pump for 2-3 minutes to ensure all the air inside Autoclave chamber is drained out , vent air inside chamber using vent port at autoclave chamber manually and then stop it using PLC .

Step II: UUT Pressurization

Now Autoclave (26.0) is filled with working fluid (ISOPAR M or L) so we select UUT Pressurization button on PLC for pressurization of chamber. During Filling operation Our intensifier (21.0) hydraulic side will Collect sufficient fluid (ISOPAR M or L) . During Pressurization PLC will automatically give 0-10 Volt Command to Electronic Pressure Regulator (4.0, 35.0) , solenoid valve (7.3, 33.0) to raise Pressure inside Autoclave chamber (26.0) by compassing the fluid inside the chamber using intensifier (21.0) and High pressure pump (22.0) . PLC will take Input from Pressure Transmitter (25.0 & 5.0) to control the pressure raise from Zero to 150 bar Inside Autoclave Chamber (26.0) in five steps from zero to 150 bar, in step pressurization for self test of chamber user can customize no of steps and test time after ensuring no leak during step pressurization user will go for UUT test operation in which chamber will be pressurized in 5 to 15 Min. After achieving Maximum pressure it will hold the pressure up to one hour and then it depressurized the system by retracting the intensifier in 5 to 15 Min. This Operation will repeat for 0-9 or more no of cycle.

User Can Set following Parameter by giving input on PLC

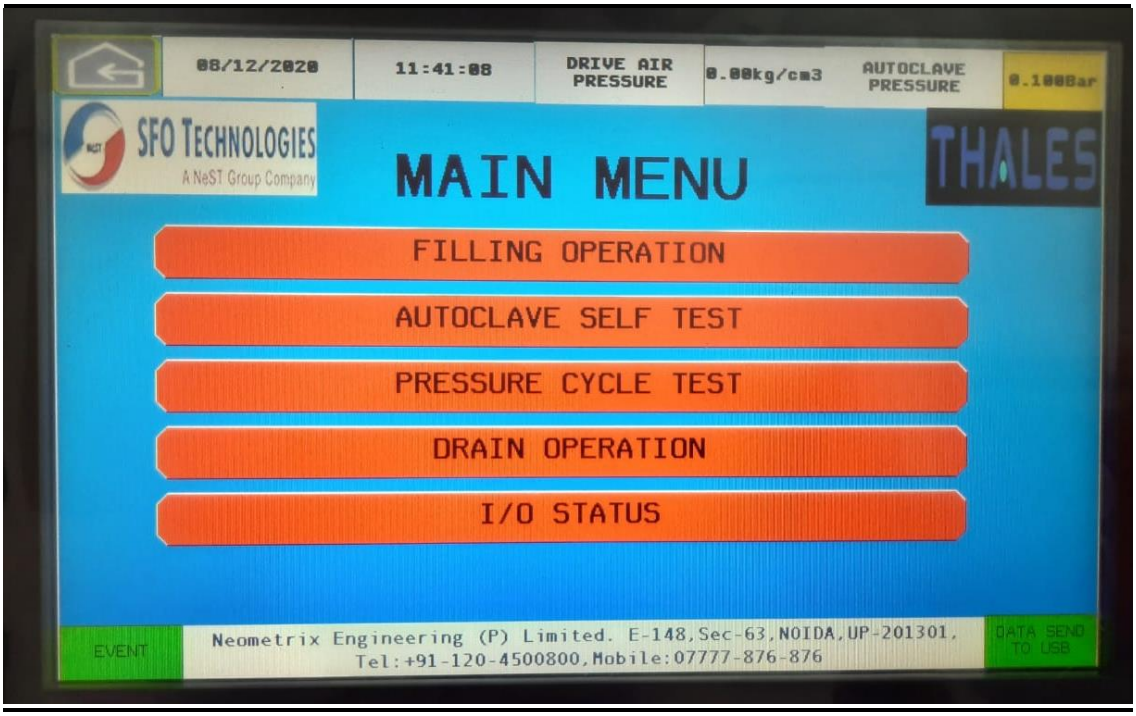
1) No of Cycle.
2) Maximum Pressure holding Time.
3) Max Pressure for Testing.

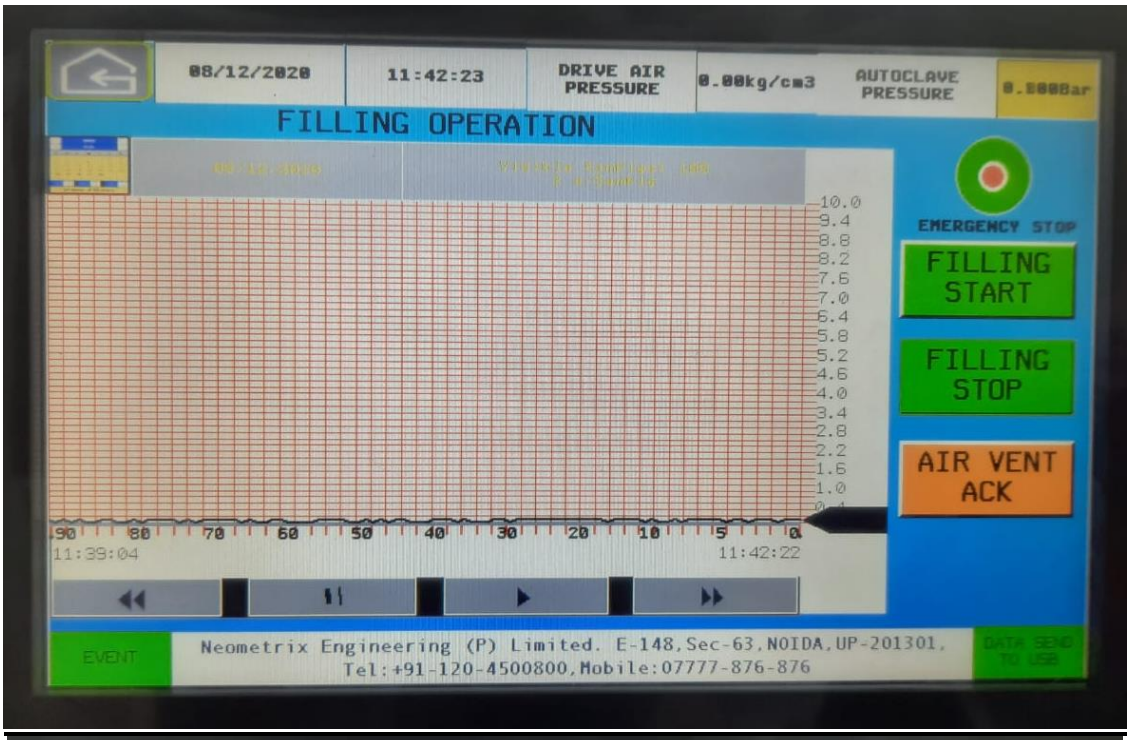
We are Using Safety relief valve (23.0) to insure safety of autoclave Chamber(26.0) .PLC will also take Input from Pressure transmitter (25.0) to insure safety of Autoclave Chamber (26.0) from over pressurization

Pressurization of Chamber Will Start only When:

1) User ensures autoclave Chamber (26.0) is Properly Tightened.
2) User ensures 6-7 Bar Air Supply is Available.
3) During Pressurization Automatic Ball Valve (27.0 & 28.0) is in Close Condition. For this PLC will get Signal from Solenoid Valve (7.1 & &.2).

5. Autoclave Pressure Tester - User Interface Points & HMI Detail

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DRIVE AIR PRESSURE
0.00kg/cm3
AUTOCLAVE PRESSURE
FILLING OPERATION
EMERGENCY STOP
FILLING START
FILLING STOP
AIR VENT ACK
11:39:04
11:42:22
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Tel:+91-120-4500800,Mobile:07777-876-876
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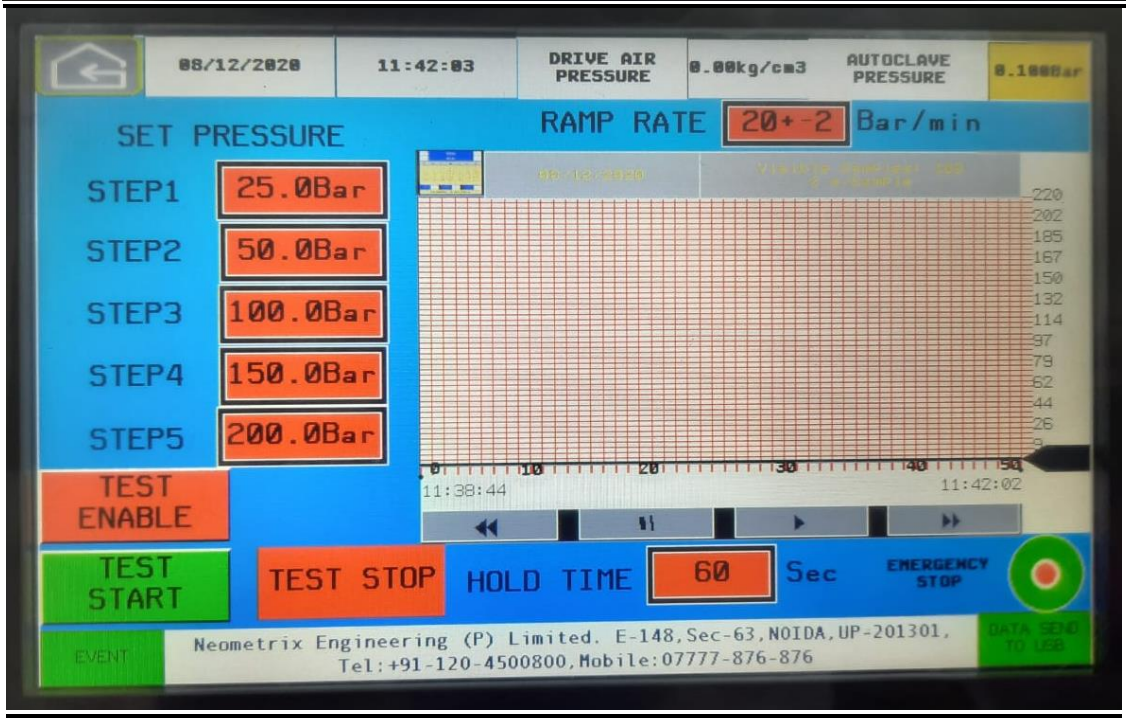
08/12/2020
11:42:03
DRIVE AIR PRESSURE
0.00kg/cm3
AUTOCLAVE PRESSURE
SET PRESSURE
RAMP RATE
20+-2
Bar/min
STEP1
25.0Bar
STEP2
50.0Bar
STEP3
100.0Bar
STEP4
150.0Bar
STEP5
200.0Bar
TEST ENABLE
TEST START
TEST STOP
HOLD TIME
60
Sec
EMERGENCY STOP
11:38:44
11:42:02
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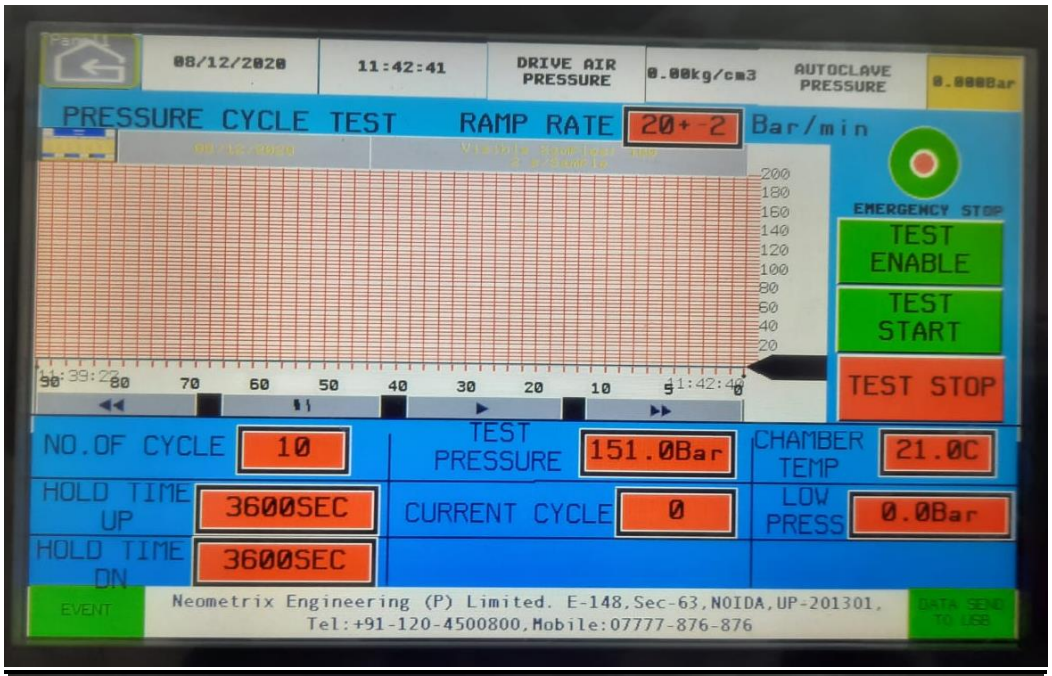
08/12/2020
11:42:41
DRIVE AIR PRESSURE
0.00kg/cm3
AUTOCLAVE PRESSURE
0.000Bar
PRESSURE CYCLE TEST
RAMP RATE
20+-2
Bar/min
EMERGENCY STOP
TEST ENABLE
TEST START
TEST STOP
NO.OF CYCLE
10
TEST PRESSURE
151.0Bar
CHAMBER TEMP
21.0C
HOLD TIME UP
3600SEC
CURRENT CYCLE
0
LOW PRESS
0.0Bar
HOLD TIME DN
3600SEC
EVENT
Neometrix Engineering (P) Limited. E-148,Sec-63,NOIDA,UP-201301,
Tel:+91-120-4500800,Mobile:07777-876-876
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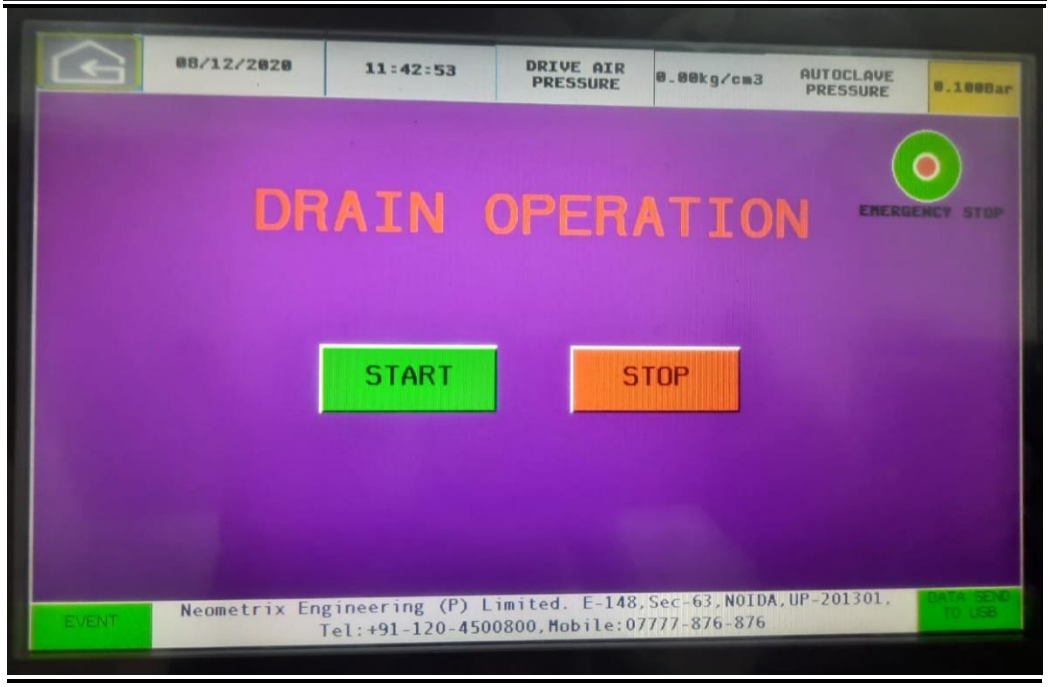
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0.00kg/cm3
AUTOCLAVE PRESSURE
0.100Bar
DRAIN OPERATION
EMERGENCY STOP
START
STOP
EVENT
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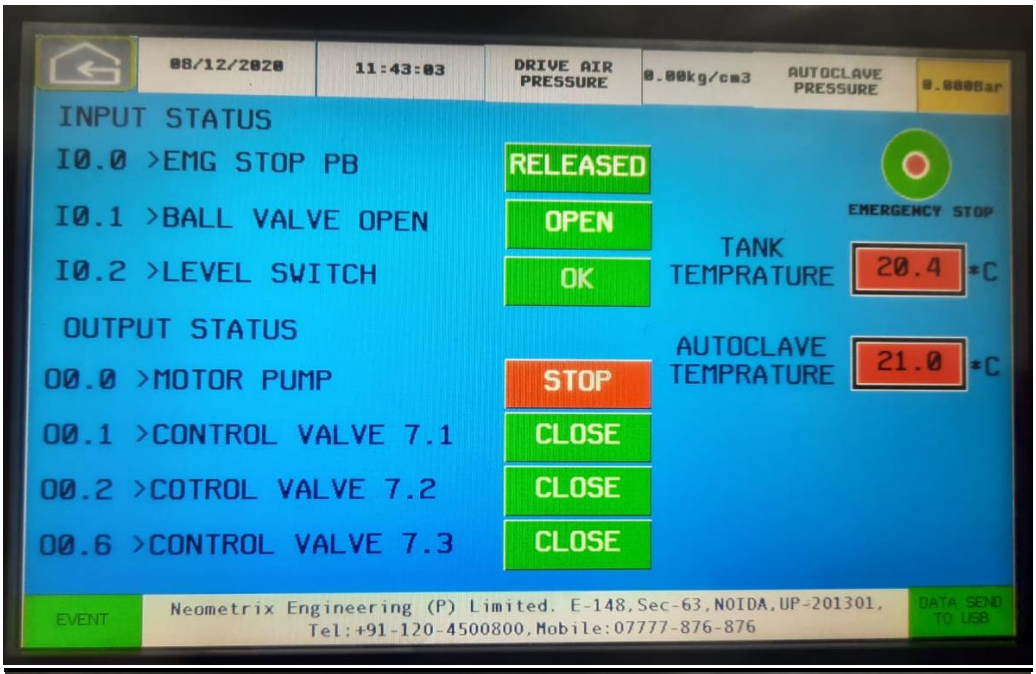
Tel:+91-120-4500800,Mobile:07777-876-876
DATA SEND TO USB


08/12/2020
11:43:03
DRIVE AIR PRESSURE
0.00kg/cm3
AUTOCLAVE PRESSURE
0.000Bar
INPUT STATUS
I0.0 >EMG STOP PB
RELEASED
I0.1 >BALL VALVE OPEN
OPEN
I0.2 >LEVEL SWITCH
OK
EMERGENCY STOP
TANK TEMPRATURE
20.4
*C
OUTPUT STATUS
AUTOCLAVE TEMPRATURE
21.0
*C
O0.0 >MOTOR PUMP
STOP
O0.1 >CONTROL VALVE 7.1
CLOSE
O0.2 >COTROL VALVE 7.2
CLOSE
O0.6 >CONTROL VALVE 7.3
CLOSE
EVENT
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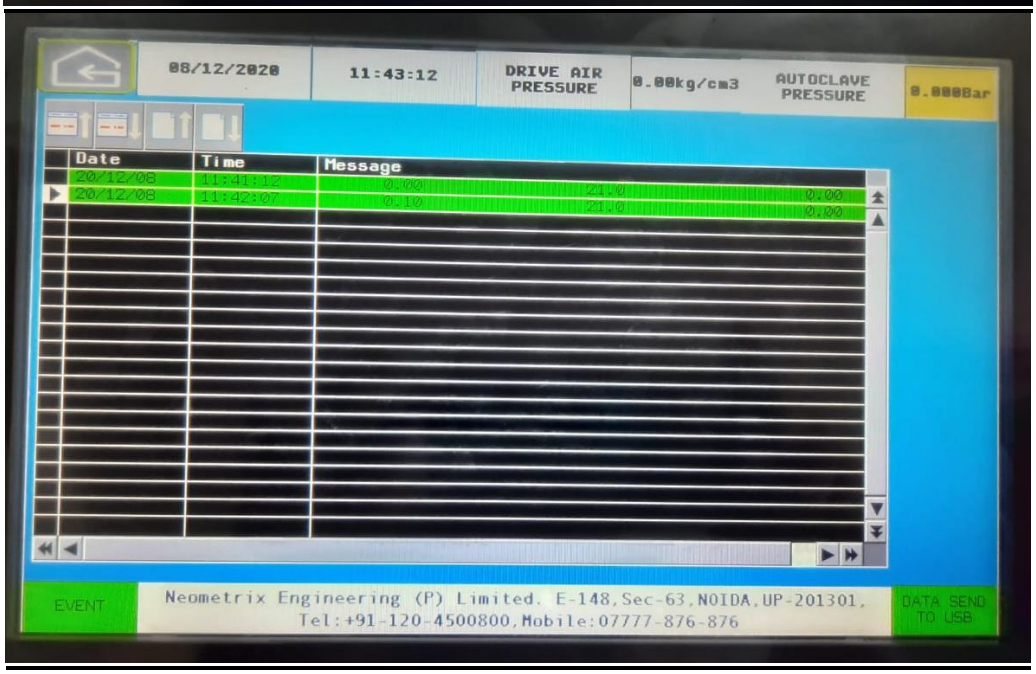
Tel:+91-120-4500800,Mobile:07777-876-876
DATA SEND TO USB


08/12/2020
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DRIVE AIR PRESSURE
0.00kg/cm3
AUTOCLAVE PRESSURE
0.000Bar
Date
Time
Message
20/12/08
11:41:12
20/12/08
11:42:07
EVENT
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Tel:+91-120-4500800,Mobile:07777-876-876
DATA SEND TO USB

6. Autoclave Pressure Tester - Unpacking & Installation

1. Upon receipt of the system, visually inspect the packing for signs of damage or mishandling. Immediately contact the carrier for an inspection if the packing is damaged or evidence of mishandling exists.
2. Carefully remove the outer crafting materials. Care must be taken during unpacking to avoid enclosure damage or scratching.
3. Inspect the system for dents, scratches, or other evidence of mishandling during shipment. Request an immediate inspection from the carrier if damage is evident.
4. Fill the hydraulic tank with clean working fluid ISOPAR M.
5. Connect the Air Drive connection at Drive air Inlet port from ground source of dry and clean compressed air (In customer scope) 7 bar .
6. Connect single phase power supply , Ampere rating 25A minimum
7. Check if suction valve (15.0, 32.0) is in open condition. Suction valve should be in open condition while in use.
8. Power on the system.
9. Put the test unit on fixture and keep it inside Autoclave chamber.
10. Close the Autoclave chamber properly.
11. Check all connections should be fully tightened.
12. Now start test in following sequence using PLC.

FILLING OPERATION ⇨ AUTOCLAVE SELF TESTING ⇨
DRAIN OPERATION ⇦ PRESSURE CYCLE TEST

7. Autoclave Pressure Tester - Safety Features

1. **All the Joints should be fully tightened.**
2. **Please don't touch any pressurized hose & Tubes during testing.**
3. **Before starting the filling make sure that Autoclave chamber must be fully tightened**
4. **Don't touch high pressurized component inside machine during operation.**
5. **Don't change setting of relief valves.**
6. **Please ensure that door of the panel must be close during pressurization.**

8. Autoclave Pressure Tester -Bill Of Material

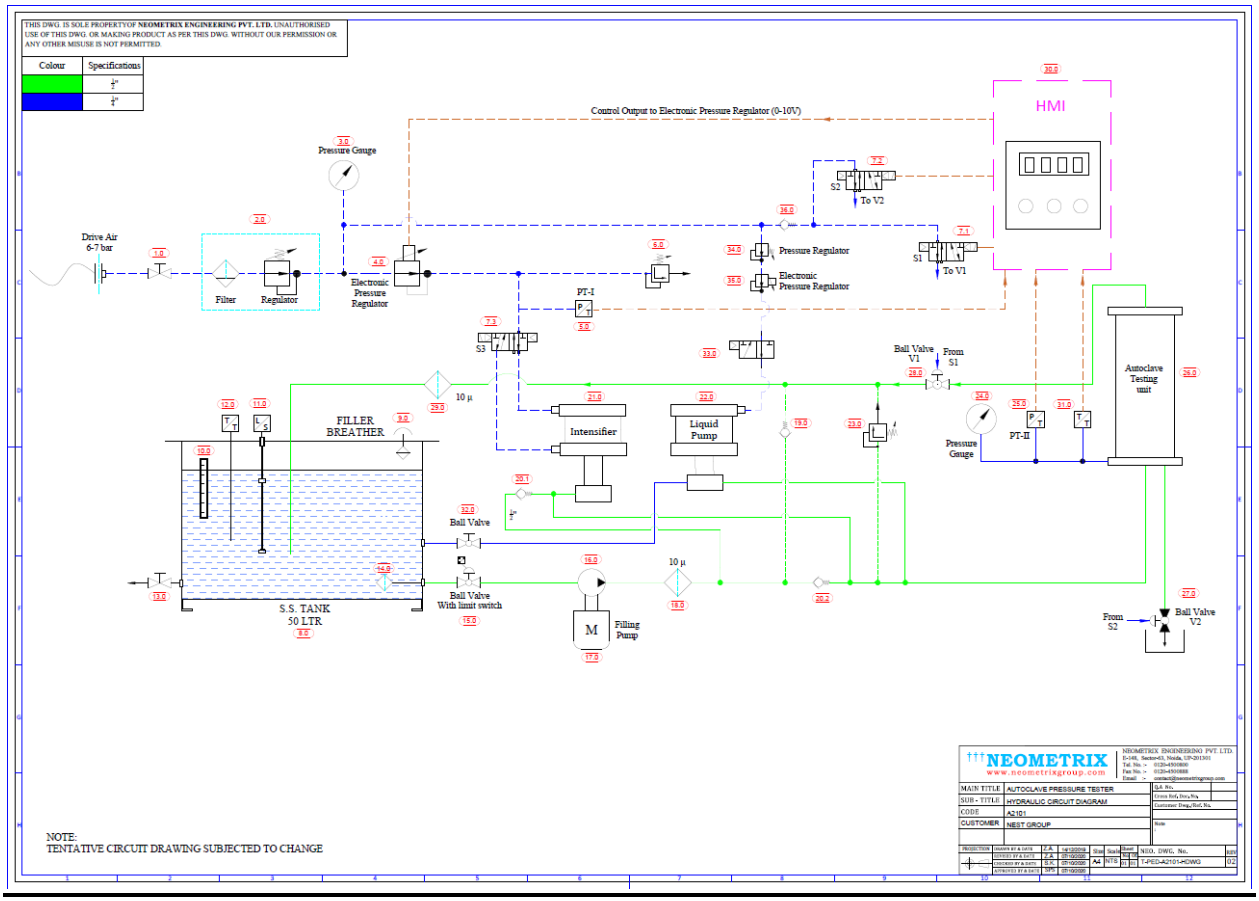
PLC Controlled Autoclave Pressure Tester						
T-DAP-A2101-BOM-REV-06						
Sl No.	Ckt. code	NX Part No.	ITEM DESCRIPTION	ITEM SPECIFICATIONS	MAKE	Qty
1	1	2A2101P0001	Ball valve	Connection: 1/2"BSP (F) Working Pressure: 10 bar Operating Medium: Air	Festo	1
2	2	2A2101P0002	Filter Regulator	Grade of Filtration: 40 micron meter End connection: 1/2'' BSP Female Working Pressure: 10 Bar Operating Medium: Air	Festo	1
3	3	2A2101P0003	Pressure Gauge	Dial size: 2.5" Pressure range: 0-16 bar Scale: Both Bar and PSI Measuring System:SS316L Movement: Stainless steel Dial: White aluminum Pointer: Black Aluminum Accuracy:1%of FS Connection: 1/2"BSP(M) back with 3 hole front flange Glycerin filling: Yes Operating Medium: Air	Wika	1
4	4	2A2101P0004	Electronic Pressure Regulator	Pressure Range 0.9Mpa , Power Supply voltage 24VDC , Input Signal 0-10VDC, Analogue output 0-5VDC , End connection 1/4'' BSP female. With 3meter cable connector , pressure display unit kg/cm2	SMC	1
5	5	2A2101P0005	Pressure Transmitter	Pressure range: 0-16 bar	Wika	1

6	6	2A2101P0006	Safety Relief Valve	Set @ 5 Bar , Port Connection: 1/4'' , Working Media : Air	Standard	1
7	7.1 , 7.2 & 7.3	2A2101P0007	Solenoid Valve5/2	Wp=8Bar DC24V Normally closed , 1/4" BSPF Port size with side bracket	SMC	3
8	8	2A2101P0008	S.S. Tank	S.S. Tank Capacity: 50 L	Neometrix	1
9	9	2A2101P0009	Filler Breather	Grade of Filtration: 40 Micron Flow Range: 750 LPM Connection Type: Flange type	Hydroline	1
10	10	2A2101P0010	Level gauge	Size - 5''	Hydroline	1
11	11	2A2101P0011	Low Level Switch	Working Fluid : Isopar Mor L	Shridhan /Standard	1
12	12	2A2101P0012	Temperature Transmitter	Working Fluid : Isopar Mor L , Range : 0-100 Deg C	Wika	1
13	13	2A2101P0013	Ball valve	Connection: 1/2"BSP (F) Working Pressure: 10 bar Operating Medium: ISOPAR M OR L	Festo	1
14	14	2A2101P0014	Suction strainer	Grade of Filtration: 149 Microns Flow Capacity: 20 LPM ; 1/2" BSPF, working media: isopar M or L	Standard	1
15	15	2A2101P0015	Ball Valve with Limit Switch	Ball Valve , Size 1/2'' ,With feedback for Limit Switch, working medium: isopar M or L	Standard	1
16	16	2A2101P0016	Filling Pump	Working Pressure : 10 bar Flow : 5 LPM working media: ISOPAR M OR L	Mini flow / Standard	1
17	17	2A2101P0017	Motor	Three Phase Motor , 2.2 Kw , 1450 RPM	standard	1
18	18	2A2101P0018	Filter	10 Micron Filter , Working Fluid Isopar M or L	Standard	1
19	19	2A2101P0019	Check Valves	Connection Size:1/2” , Cracking pressure 5 Bar Max Pressure:6000 psi (414 bar)	Standard	1
20	20.1 & 20.2	2A2101P0020	Check Valves	Connection Size:1/2” , Cracking pressure 0.5 bar ,Max Pressure:6000 psi (414 bar)	Hamlet	2

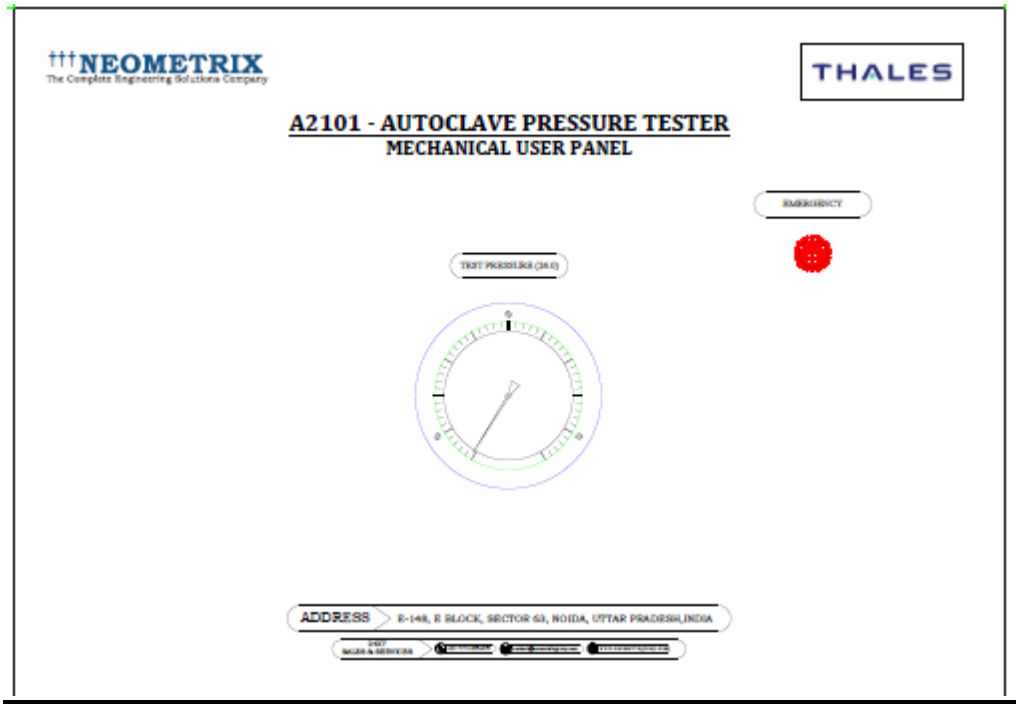
21	21	2A2101P0021	Intensifier	Intensifier , Pressurize up to 150 bar, working media: ISOPAR M OR L	Neometrix	1
22	22	2A2101P0022	Liquid pump	Driving media : air , working media : ISOPAR M	Haskel	1
23	23	2A2101P0023	Relief valve	cracking pressure 155 - 206 bar ,	Hamlet	
24	24	2A2101P0024	Pressure gauge	Dial size: 4" Pressure range: 0-280 bar Scale: Both Bar and PSI Measuring system:SS316L Movement: Stainless steel Dial: White Aluminum Pointer: Black Aluminum Accuracy:1%of FS Connection: 1/2"BSP(M) back with 3 hole front flange Glycerin filling: Yes, WORKING MEDIA: ISOPAR M OR L	Wika	1
25	25	2A2101P0025	Pressure Transmitter	Pressure range: 0-280 bar, WORKING MEDIUM: ISOPAR M OR L	Wika	1
26	26	2A2101P0026	autoclave pressure unit	Material : 304 stainless steel ; It can Accommodate 10 No of Units at a time. Inner diameter : 177 mm Approx. working Inner Height : 510 mm Approx., Maximum working pressure : 200 bar Maximum working temperature : 10 ˚C to 45 ˚C	Standard	1
27	27	2A2101P0027	Automatic Ball Valve	High Pressure Automatic Ball Valve , Size 1/2'' , with Pneumatic Actuator for control , Double Acting ,working medium: isopar M or L	Hamlet	1
28	28	2A2101P0028	Automatic Ball Valve	High Pressure Automatic Ball Valve , Size 1/2'' , with Pneumatic Actuator for control , Double Acting ,working medium: isopar M or L	Hamlet	1

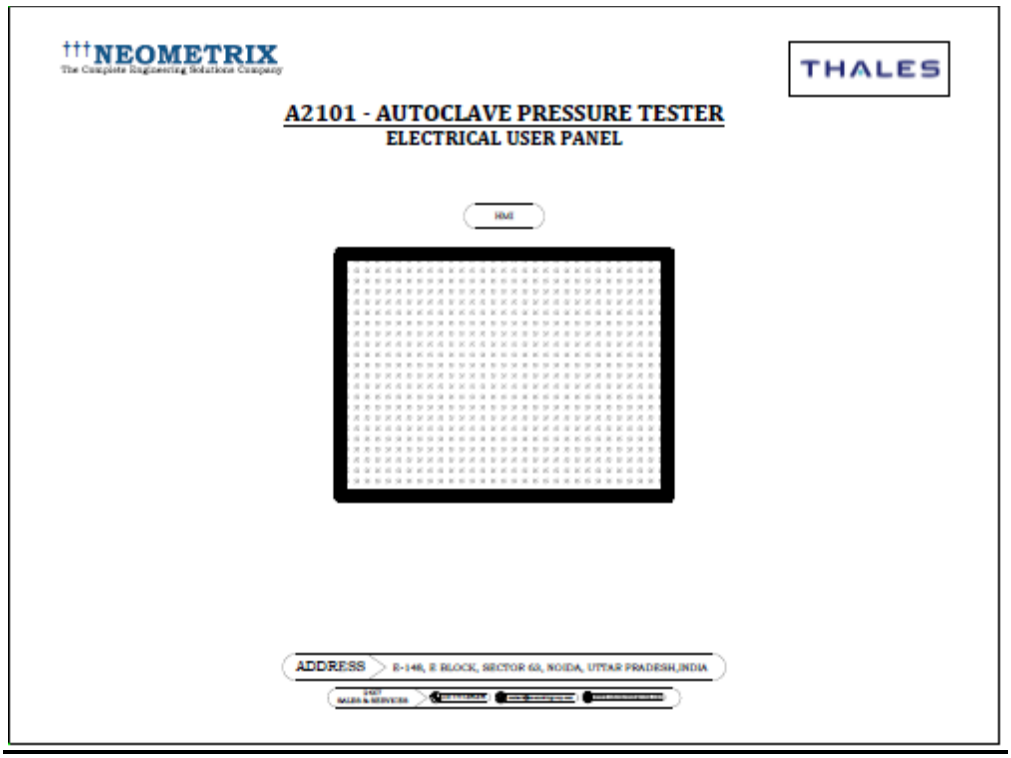
29	29	2A2101P0029	Return line filter	Working Pressure : 10 bar Flow : 10 LPM working media: isopar M or L	Standard	1
30	30	2A2101P0030	PLC Programming (HMI) Controller	10 '' Touch Screen	Schneider	1
31	31	2A2101P00 31	Temperature Transmitter	Working Fluid : Isopar Mor L , Range : 0-100 Deg C	Wika	1
32	32	2A2101P0032	Ball valve	Connection: 1/2"BSP (F) Working Pressure: 10 bar Operating Medium: ISOPAR M OR L	Festo	1
33	33	2A2101P0033	Solenoid Valve3/2	Wp=8Bar DC24V Normally closed , 1/4" BSPF Port size with side bracket	SMC	1
34	34	2A2101P0034	Pressure Regulator	End connection: 1/4'' BSP Female Working Pressure: 07 Bar Operating Medium: Air	SMC	1
35	35	2A2101P0035	Electronic Pressure Regulator	Pressure Range 0.5 Mpa , Power Supply voltage 24VDC , Input Signal 0-10VDC, Analogue output 0-5VDC , End connection 1/4'' BSP female. With 3meter cable connector , pressure display unit kg/cm2	SMC	1
36	36	2A2101P00236	Check Valves	Connection Size:1/4” , Cracking pressure 0.5 bar ,Max working Pressure:10bar , working media : Air	standard	1
37	N/A	2A2101P0037	Electrical Junction Box	As per requirement	Neometrix	1
38	N/A	2A2101P0038	Tube & Fittings	As per requirement	Hamlet / Standard	1
39	N/A	2A2101P0039	Panel	As per Drawing	Neometrix	1
40	N/A	2A2101P0040	Drying Tray	Material Of construction : Ss - 304, Made of 3 mm thickness sheet with all four sides bend of 50 mm to Accommodate 10 Nos of Unit at a time ; Size of Tray : 500 mm X 500 mm X 50 mm	Neometrix	1

9. Circuit Diagram of Autoclave Pressure Tester



10. Panel MIMIC Diagram




NEOMETRIX
The Complete Engineering Solutions Company
THALES
A2101 - AUTOCLAVE PRESSURE TESTER
ELECTRICAL USER PANEL
HMI
ADDRESS
E-148, E BLOCK, SECTOR 63, NOIDA, UTTAR PRADESH,INDIA

11.Panel GA (General Appearance) Drawing

12. Service & Maintenance Instructions

FREQUENCY		(service and maintenance actions)
Before / after each use	Δ	Check power supply. Perform the visual check of the complete System.
	Δ	During Operation observe leakage, if any.
	Δ	Release Pressure from All Pressure Gauges/Pressure Transmitters on the Panel. Each gauge/Digital Indicator on the Panel should READ ZERO Pressure after completion Of operation.
Every Month	Δ	Check for the Leakage of the tubing/Piping And fittings, if any. Clean the complete System to ensure Dust & Dirt Free system.
Every 6 months	Δ	Check the Pump for external leakage & Overall performance.
	Δ	Clean the Filter and Filter Elements
	Δ	Check for loosening of Nuts and bolts or pipe Adaptors. Re-torque if needed
	Δ	Inspect piping at full system pressure for Leakage using pressure drop.
Every 12 Months	Δ	Test & calibrate all pressure Gauges/ Sensors / Transmitters. Check All Wire condition.
	Δ	Check All filter ELEMENTS.
	Δ	Get Valve, Pressure Relief Valve in the Checked for performance.

Every 5 Years	Δ	Change the all major Items :Flow Meter, Relief Valve, Intensifier , Motor, Electronic pressure regulator ,power supply , Pump etc.

Weekly Maintenance:

Nut bolt tightness of system, pipe flanges bolts, pipe adaptors, and pipe Connectors, tube fittings looseness any nut bolts are pipe related which are exposed to vibrations.

Monthly Maintenance:

Any soft sealing in pipe line check, manifolds seating area check for every month, change oil every 6 week, calibration certificate of Instruments and Gauges fold the hose and check crack line etc.

Yearly Maintenance:

Calibration of Instruments and Gauges, any Wear and tear due to vibration in system, fold the hose and check both supply and return Line etc.

13. Sales /Service/Support Contact Details

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