PLOT NO. 1131 HARI ENCLAVE KIRARI SLEMAN NAGAR NEW DELHI-110086
2ND PLANT H-936 RIICO CHOPANKI INDUSTRIAL AREA ALWAR RAJSTHAN-301707

RESOTECH THERMAL TESTING PROPOSAL

Professional Manufacturer of Test Equipment

Type of Testing

- Thermal shock chamber

MAKE : RESOTECH
MODEL NO. RESOTECH THERMAL-0116

MANUFACTURERS & SUPPLERS

SPECIAL PURPOSE MACHINE, MATERIAL TESTING MACHINE, LEAKAGE TESTING MACHINE, PACKIGING TESTING MACHINE, ENVIRONMENTAL TEST CHAMBER, ASSY. LINE EQUIPMENT, SOLUTION FOR ELECTRONIC AUTOMATION AND PRODUCT DEVELOPMENT, COMPUTERIZED CONTROL MACHINE , PLC HMI SCADA VISUAL BASIC SOFTWARE DEVELOPMENT SOLUTION AND OTHER SERVICES.

The mechanical properties of materials are determined by performing carefully designed laboratory experiments that replicate as nearly as possible the service conditions. In the real life, there are many factors involved in the nature in which loads are applied on a material. The following are some common examples of how these loads might be applied: UNIVERSAL, compressive and shear, just to name a few. These properties are important in materials selections for mechanical design.

RESOTECH®

Description:

Originally developed for testing microelectronic devices for use in military and aerospace electronic systems, Bemco FSV Vertical, and TS Rotary, Thermal Shock Chambers are widely used for screening and quality evaluation of smaller electronic parts.

Today's modern RESOTECH thermal shock chambers include many unmatched features such as safe, no cable, hydraulic transfer systems, temperature ranges up to -130 C to +200 C, all welded interior construction, and high volume air circulation.

The unique RESOTECH TS series rotary thermal shock chambers use both the hot and cold zones 100% of the time, greatly improving operating efficiency.

With experience in making environmental test equipment, we have a shock chamber to fit almost any requirement.

Why settle for the appear-ance of testing when you can have a system that actually works?

Choose RESOTECH , the true experts in Thermal Shock.

FS Construction

FS Construction

FS2V and FS3V chambers include a 304 series stainless steel weldedinner liner with high temperature fiberglass insulation. No asbestos isused in chamber construction.

The chamber outer case is fabricat-ed from cold rolled steel finished in Bemco Blue. Chamber doors featuredual gaskets to fully vapor seal each compartment when the chamber is in operation.

The internal transfer carriage is made from stainless steel. Four internal posts guide the cage and support optional test item fixturing,shelves, or baskets.

A double acting hydraulic pistonand a built-in Bemco hydraulic power unit smoothly transfers theload basket(s) from chamber to chamber.

To increase safety, the hydraulic pis- ton is operated to its full stroke and is double acting so that transfers take place under full speed control.

No cables or cable tensioning sys- tems subject to wear and potential-ly dangerous failure are used. The transfer system includes a posi- tive mechanical transfer carriage lock, transfer carriage position indi- cators, limit switches in the hydrau- lic piston, and a time delay sensor set to sense transfer failure.

The electrical control panel ishinged for easy access.

Conditioning

Chamber air in both the hot chamber(s) and the cold chamber is recirculated by high volume, stain- less steel blowers drawing air in on the right side of the workspace and discharging on the left. Air flows through a diffuser baffle to createa uniform high velocity environ- ment in excess of 10 feet per second(600 feet per minute) around and through your test objects.

The air circulation blowers are driven by externally mounted TEFC (totally enclosed fan cooled) motors with dual ball bearing races, con- nected by large diameter extendedstainless steel shafts.

Fast-response open type heat- ers behind a radiation baffle raisechamber temperature in the hot compartment.

All electrical wiring meets the Unit-ed States National Electric Code. U.L. and CSA approved componentsare used where possible

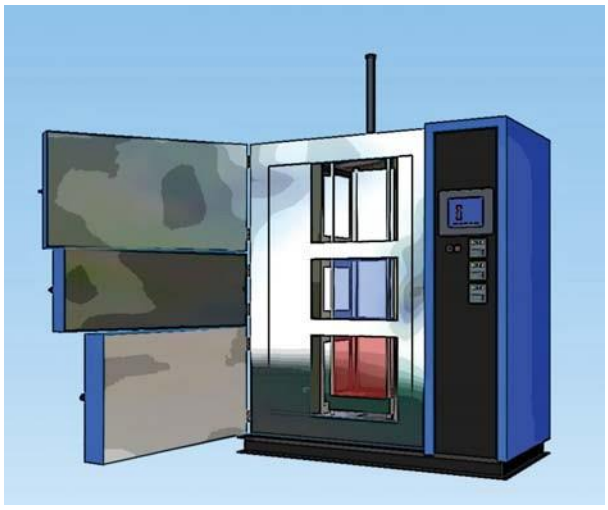
Cooling

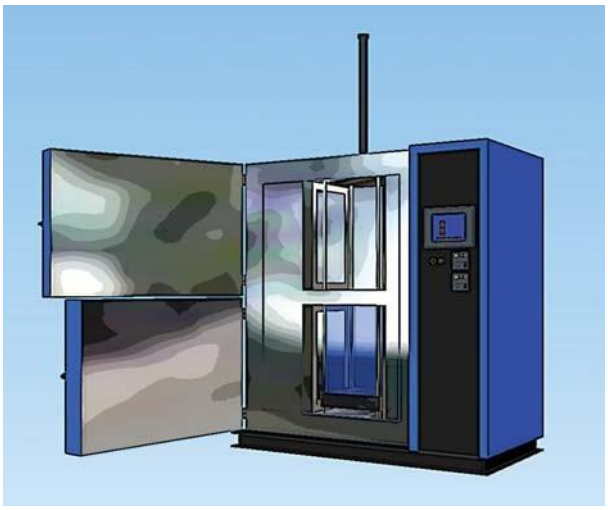
Mechanically refrigerated systems include a proportionally controlled cascade, two compressor, refrig- eration system utilizing modern environmentally friendly refriger ants to cool the workspace in thecold compartment. The system includes automatic hot gas bypassand suction cooling unloading aswell as Bemco's exclusive, high performance coaxial cascade heatexchanger.

All systems are water cooled, have thermal and current sensors on eachcompressor, and feature numerous safety and reliability protection sys-tems for dependable operation. Mechanical systems require no expendable refrigerants to recoverto specified conditions.

Sketch of a Bemco Model FS3V3, Three Zone Vertical Thermal Shock Chamber, shown with the loads in thelower hot chamber and middle cold chamber.

Sketch of a Bemco Model FS2V3, Two Zone Vertical Ther-mal Shock Chamber, shown with the load in the lower cold chamber.





For liquid nitrogen (LN2) cooledsystems, chamber temperature is reduced by a proportionally controlled liquid nitrogen injection system utilizing both a controlsolenoid and a series mounted safety solenoid to positively inter- rupt nitrogen flow in the event of amalfunction.

A relief valve and a line strainer are provided for dependable operation. A self-sealing vent system with anattachment coupling for remote piping by others, removes expand-ed nitrogen from the workspace.

Controls

Each Bemco FS2V chamber isfurnished with a two channel microprocessor based program-

mable 1/4-DIN, solid state, 256-stepramping controller which includes a 4-line LCD interface display and a large red LED display. This instru-

ment is pre-programmed to control both the hot chamber and the cold chamber automatically.

Temperature inside both chambers is sensed in the return air (after the load) by precision thermocouples.

An RS232 and RS485 interface is standard

On the three zone chamber, an additional microprocessor based programmable 1/4-DIN, solid state,controller with a 4-line LCD interface display and a large red LED display is used to control the cold zone. This instrument is interlockedwith the primary sequencing control, monitoring the two hot zones.

Heaters are interlocked with a sepa-rate heavy duty power contactor and a factory preset high tempera-ture safety control.

A microprocessor-based, FM Ap-proved, high temperature safety control is standard on all hot cham-bers and a separate FM Approved low temperature control is stan- dard on all liquid nitrogen cooledchambers.

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Material Properties for Heat Transfer

Test Item	Density	Density	Cp	Conductivity	Conductivity
Material	lb/in³	lb/ft³	Btu/F-lb	Btu-in/hr-F-ft²	Btu/hr-F-ft
Metals					
Aluminum	0.098	169.344	0.214	1540.000	128.33333
Brass	0.308	532.000	0.092	672.000	56.00000
Bronze	0.313	540.000	0.082	180.000	15.00000
Copper	0.322	556.416	0.095	2680.000	223.33333
Silver	0.379	655.000	0.056	2856.000	238.00000
Steel	0.284	490.752	0.120	460.000	38.33333
Stainless Steel	0.286	494.208	0.122	105.000	8.75000
Non-Metallics					
Delrin	0.051	88.128	0.350	1.600	0.13333
Fiberglass Insulation	0.002	4.000	0.120	0.270	0.02250
Glass	0.101	174.528	0.120	7.500	0.62500
Phenolic	0.046	79.488	0.400	1.000	0.08333
Polyethylene	0.035	60.480	0.550	2.300	0.19167
Polystyrene	0.038	65.664	0.320	0.850	0.07083
Rubber	0.044	76.032	0.440	1.100	0.09167
Urethane Foam	0.001	2.000	0.300	0.150	0.01250
Assemblies					
Circuit Board, G-10	0.069	120.000	0.143	7.500	0.62500
Electronic Components	0.069	120.000	0.300	5.000	0.41667
16 Pin DIP, 360 / pound	0.081	140.000	0.200	10.000	0.83333

RESOTECH®

Test Load Ratings

The ability of a Bemco FS2V or FS3VThermal Shock Chamber to recover to the specified test temperature in the required time varies with

the presentation of the test load tothe circulating air in the chamber workspace.

Test load ratings also change withthe Military Specification or test protocol, the test item density, and the test item's material composition.

The simplified information present-ed below is for your use in understanding the technical issues we routinely evaluate on your behalf

A short but useful list of C_p (SpecificHeat) in Btu/F-lb, density in lb/ft^3, and conductivity in Btu/hour-F-ft, isgiven in a table on the left.

Many manufacturers of thermal shock chambers rate their machinesin pounds of material based on a given test protocol, usually MIL-STD 883 Methods 1010.5, 1010.6, and 1010.7. They typically state performance in terms of pounds ofIC's (integrated circuits) inside thechamber and give conversion factors using material specific heat (C_p), usually stated in consistent unitssuch as Btu/F-lb, to convert their rating to other materials that mightbe tested.

The formula given by some manu-factures for this conversion is:

Equivalent Load = C_p / 0.35

Where:

Cp = Btu/F-lb

0.35 = C_p of mixed average elec- tronic components and other higher specific heat materials. Typically they use 16 Pin DIP'sfor testing.

Unfortunately, this simplification overlooks a number of factors. 16 DIPs vary greatly in encapsulating material composition and interior structure. One set of these devices measured at Bemco are 59% Silicon (glass), 27% Phenolic, and 15% tin coated copper. These devices weigh360/pound, have an exposed area of 2.5 ft^2/lb, and occupy a volume of 12.3 in^3/lb.

Their specific heat calculates to 0.195 Btu/lb-F. Our table shows arecommended value of 0.2. The problem is that the conversion

factor given by some vendors of
0.35 Btu/lb-F results in an overstate-ment of load capacity by a factor of 0.35/0.20 = 1.75.

Additionally, the energy that must be handled by each chamber com- partment in a thermal shock cham- ber is governed by three factors
associated with your load configura- tion rather than just one. Each interact, one with another, and contribute to the result. The threefactors are:

- Transient resistance to change
- Surface heat transfer resistance
- Conductive resistance

Each contributes to your overallthermal shock testing result.

Since an analysis of conductive resistance from the center of yourparts to their surface can be very complicated, it is not covered here.

A simplified formula for **thermal resistance to change** is:

A useful **approximate equation for calculating the forced convection heat transfer coefficient** on a planesurface in air is given in the Ameri- can Society of Heating, Refrigerat-
ing, and Air-Conditioning Engineers(ASHRAE) in their Handbook Chap- ter on Heat Transfer as:

$h_o = 0.99 + 0.21 * A_v = 0.99 + .21$
$* 10 = 3.09$ Btuh/F-ft2

Q_{tr} = Energy required, Btuh

C_p = 0.35 Btu/F-lbW_g

= 35 lb

dT = (175-(-65) * 1.8 F = 432 F

dQ = 10/60 hours = 0.1667 hoursQ_{tr} =

31,752 Btuh or 9,306 watts

Well within the thermal capabilities of most Bemco FS2V and FS3V chambers starting with the FS2V8 and the FS3V8 models.

The **surface heat transfer resistance formula** tells us that the amount of energy a test item can transfer per unit time is limited bythe surface heat transfer rate, the surface area, and the average tem-perature difference.

Using the same example, with theload having a total surface area of 87.5 ft^2, how much energy can wetransfer per hour?

$Q_h = h_o * A_o * (T_s - T_{ca})$

Where:

Q_h = Surface heat transfer rate onthe load, Btuh

h_o = 3.09 Btuh/F-ft^2 A_o

= 87.5 ft^2

T_s = (175-(-65) * 1.8 F / 2 = 216 FT_{ca} = -65 F

Q_h = 75,975 Btuh

The value of T_s is divided by two, assuming that the test load startsat 175 C at the beginning of the transfer and ends at -65 C at theend of the allowed time of 10 minutes.

Similarly, the value of T_{ca} is given as -65 C, assuming that the air temper-ature recovers in the Bemco lower chamber instantly. An assumption that gives the maximum possible value for heat transfer rather than the likely lower value caused by heating induced by the introduc- tion of the test load into the cold chamber workspace.

The calculation also assumes that each part is perfectly exposed on every side to the air flowing over it. A configuration meeting this constraint is one layer, every device supported by its pins, with the pins facing down on a shelf that does not block air flow.

What happens if we put the parts inbaskets so that only edge parts are exposed to the air? If the exposed area is now 10 ft^2 the same calcula- tion yields a value of 8,683 Btuh.

We notice the problem immediately.The test load does not have enough surface area to track the temperature change.

The Bottom Line

Test load arrangement and test fixturing can greatly affect the results you achieve by testing.

The optimum thermal shock test fixturing pattern presents all sides of each test load to the flowing chamber air.

Test fixturing that requires stacking parts or placing them in basketcontainers more than a few parts deep should be carefully analyzed for thermal response.

The analysis of the response ofa specific combination of load, chamber, and specification can get quite complicated. Since we specialize in this type of work, we have automated programs that performa very rigorous thermal analysis of both your test load and our thermalshock chambers.

We are happy to provide this serviceto you at no charge. For evaluation of component parts, at least two ounces (0.125 pounds) of representative parts of each type you want us to look at are required foranalysis.

Optional Equipment

Both the FS2V and the FS3V systemsare available in custom shapes and sizes. They are also offered with specially modified conditioning systems, air circulation patterns, transfer mechanisms and control

THERMAL SHOCK CHAMBER SOLUTION BY RESOTECH

systems. Please request an analysis of your needs.

FS Standard Options

- Windows and interior lights in one or more compartments. Window sizes are 12" x 12" and 18" x 18" clear viewing area.
- A 1" traveling tube access port. This port exits through the chamber top and raises and low- ers with the transfer cage.
- Access Ports in the side of any compartment. Standard sizes are 2", 3", 4" and 6."
- Casters, four swivel type, with locks.
- Shelf pilasters and wire-type stainless steel shelves in each bay.
- Shelf pilasters and basket-type stainless steel shelves, 2" deep ineach bay.
- LN2 boost cooling with vent for extra or back-up cooling.
- GN2 gas purge with pressure regulator, gauge, flow measuring and regulating valved rotameter, and vent in each bay.
- Desiccant drier purge with dual tower 10 cfm desiccant drier, pressure regulator, gauge, flow measuring and regulat- ing valved rotameter, and ventpiped to each bay.
- For systems with mechanical refrigeration, two refrigeration gauges per compressor, four total, mounted in the refrigera- tion package available with or without isolation valves.
- A high capacity hydraulic trans-fer system for handling larger, overweight, loads.
- A heating system in the cold chamber to allow part-time use of the cold chamber as an envi- ronmental test chamber.
- An automatic cold chamber de- frost system including a defrost heater and a defrost timer.
- A remote, air cooled, refrig- eration system condenser for mounting by your qualified air conditioning contractor or Bemco factory technicians, up to50 feet from the chamber, on a roof or outside your building.
- A quiet package to reduce noise on either liquid nitrogen or me- chanically refrigerated systems.

FS Instrument Options

- Microprocessor-based, FM Approved under-temperature safety control for a mechanically cooled FS2V or FS3V system. FM Approved over-temperature safety controls are standard on all systems and under-tempera- ture controls are standard on LN_2cooled chambers.
- Remote control over an Ethernet Link.
- A 12 inch, chart printing, two or four channel circular chart recorder.
- A 4 channel strip chart recorder, Honeywell model DPR3000.
- A system elapsed time meter.
- A digital temperature indicator for FS2V, 2 Zone systems.
- A digital temperature indicator for FS3V, 3 Zone systems.
- A smoke alarm, one per bay, to monitor for problems with the test load.
- A 10 inch nominal, touch screen HMI, (Human Machine Interface) coupled to an Allen Bradley PLC to replace the main system con- trols and switches. This system includes a main switch and an emergency stop button.

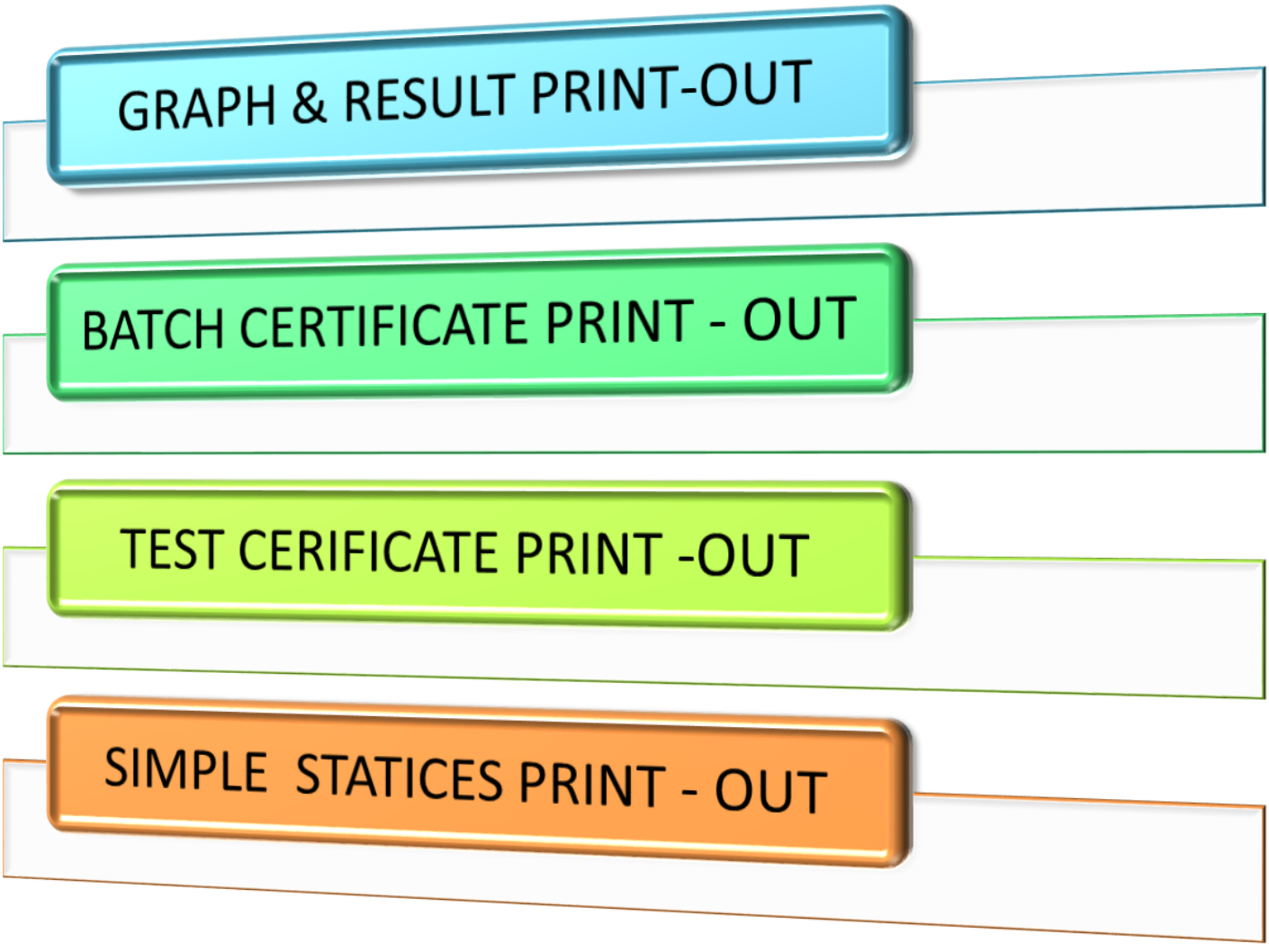
- Graphical Representation
  1. Load V/S Displacement
  2. Stress V/S Strain
  3. Load V/S Time
  4. Displacement V/S Time
- Report Format

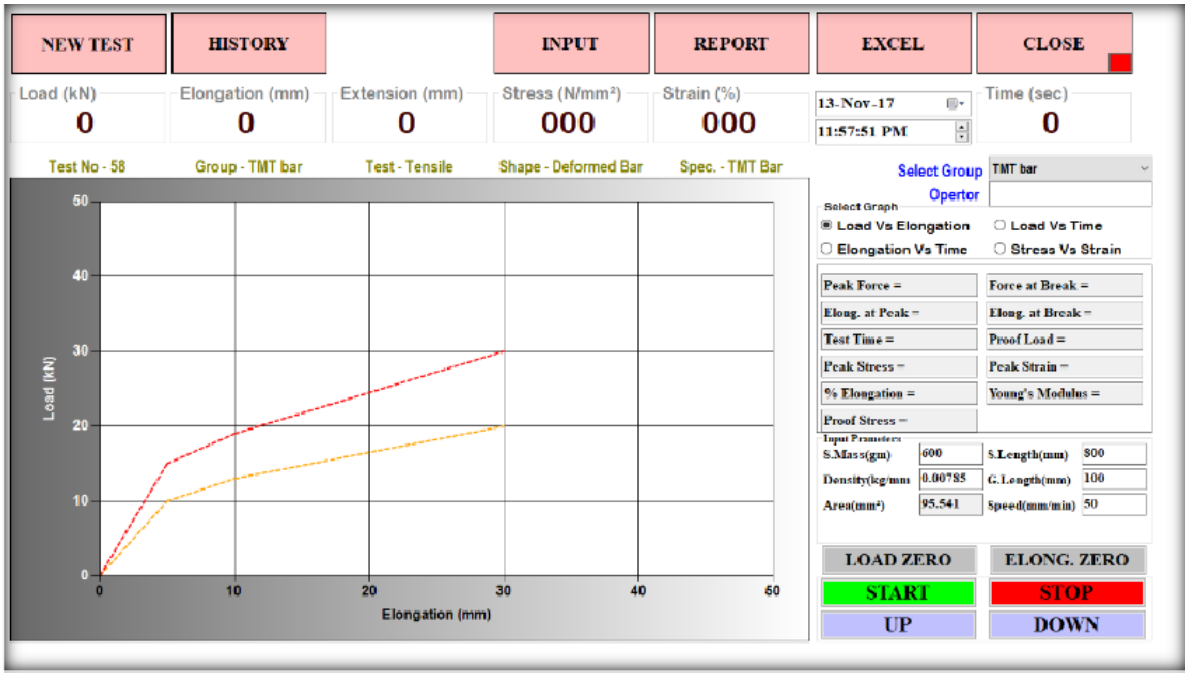
  Excel

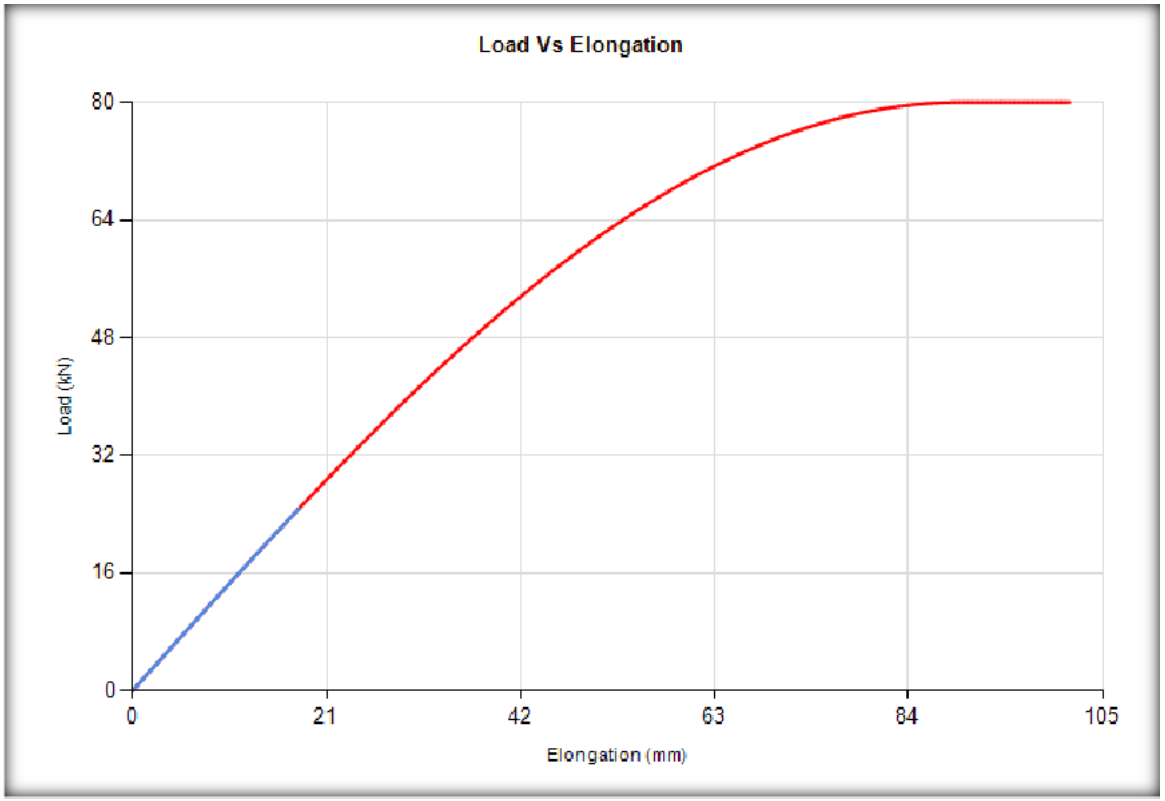
  Pdf

  word

PRINTER PORT FOR PRINTER INTERFACE




NEW TEST
HISTORY
INPUT
REPORT
EXCEL
CLOSE
Load (kN)
0
Elongation (mm)
0
Extension (mm)
0
Stress (N/mm²)
000
Strain (%)
000
13-Nov-17
11:57:51 PM
Time (sec)
0
Test No - 58
Group - TMT bar
Test - Tensile
Shape - Deformed Bar
Spec. - TMT Bar
Select Group
TMT bar
Opertor
Select Graph
Load Vs Elongation
Load Vs Time
Elongation Vs Time
Stress Vs Strain
Peak Force =
Force at Break =
Elong. at Peak =
Elong. at Break =
Test Time =
Proof Load =
Peak Stress =
Peak Strain =
% Elongation =
Young's Modulus =
Proof Stress =
Input Parameters
S.Mass(gm)
600
S.Length(mm)
800
Density(kg/mm
0.00785
G.Length(mm)
100
Area(mm²)
95.541
Speed(mm/min)
50
LOAD ZERO
ELONG. ZERO
START
STOP
UP
DOWN
Load (kN)
Elongation (mm)


Load Vs Elongation
Load (kN)
Elongation (mm)

SOFTWARE TEST SCREEN

NEW TEST

New Test – Old Test data and graph get cleared and ready for new test.

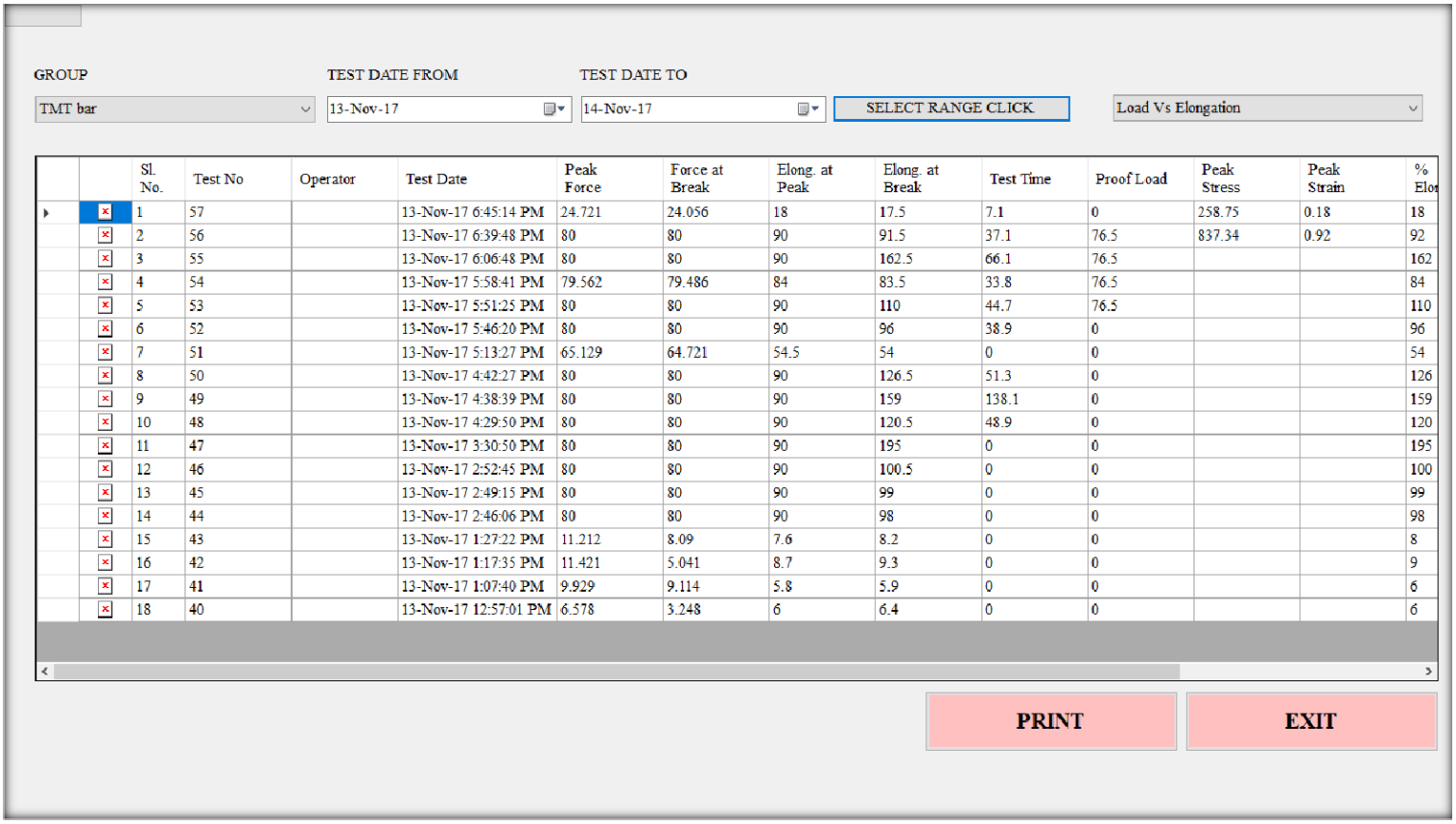
User has to select the group in which he want to do testing.

When user select a group all settings get loaded.

HISTORY

HISTORY

Here user can see all previous test and take print out from here.



GROUP: TMT bar | TEST DATE FROM: 13-Nov-17 | TEST DATE TO: 14-Nov-17 | SELECT RANGE CLICK | Load Vs Elongation

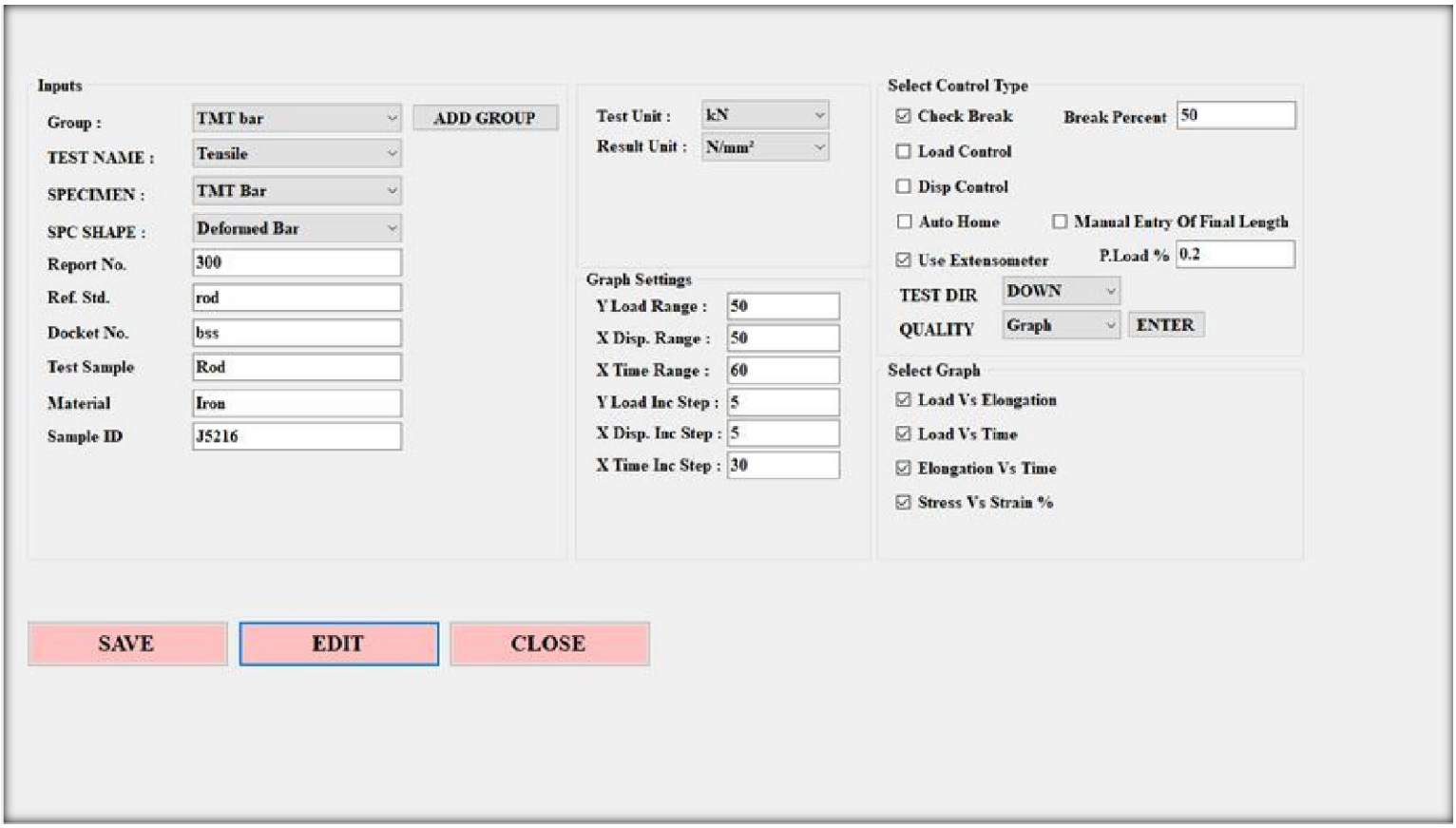
Sl. No.	Test No	Operator	Test Date	Peak Force	Force at Break	Elong. at Peak	Elong. at Break	Test Time	Proof Load	Peak Stress	Peak Strain	% Elo
1	57		13-Nov-17 6:45:14 PM	24.721	24.056	18	17.5	7.1	0	258.75	0.18	18
2	56		13-Nov-17 6:39:48 PM	80	80	90	91.5	37.1	76.5	837.34	0.92	92
3	55		13-Nov-17 6:06:48 PM	80	80	90	162.5	66.1	76.5			162
4	54		13-Nov-17 5:58:41 PM	79.562	79.486	84	83.5	33.8	76.5			84
5	53		13-Nov-17 5:51:25 PM	80	80	90	110	44.7	76.5			110
6	52		13-Nov-17 5:46:20 PM	80	80	90	96	38.9	0			96
7	51		13-Nov-17 5:13:27 PM	65.129	64.721	54.5	54	0	0			54
8	50		13-Nov-17 4:42:27 PM	80	80	90	126.5	51.3	0			126
9	49		13-Nov-17 4:38:39 PM	80	80	90	159	138.1	0			159
10	48		13-Nov-17 4:29:50 PM	80	80	90	120.5	48.9	0			120
11	47		13-Nov-17 3:30:50 PM	80	80	90	195	0	0			195
12	46		13-Nov-17 2:52:45 PM	80	80	90	100.5	0	0			100
13	45		13-Nov-17 2:49:15 PM	80	80	90	99	0	0			99
14	44		13-Nov-17 2:46:06 PM	80	80	90	98	0	0			98
15	43		13-Nov-17 1:27:22 PM	11.212	8.09	7.6	8.2	0	0			8
16	42		13-Nov-17 1:17:35 PM	11.421	5.041	8.7	9.3	0	0			9
17	41		13-Nov-17 1:07:40 PM	9.929	9.114	5.8	5.9	0	0			6
18	40		13-Nov-17 12:57:01 PM	6.578	3.248	6	6.4	0	0			6

PRINT | EXIT

INPUT

INPUT

All input settings are set here. Test Unit, Result Unit, Break Checking, Set Load, and Set Disp., whether to use extensometer or not, if proof load required set percentage for proof load, Test Direction and all other input parameters like test type, specimen, shape etc. Graph



REPORT

After each testing the report will be auto generated and saved into specified folder. User can generate a report directly from testing window and from history. range settings also here.

COMPANY NAME

Address

Contact number

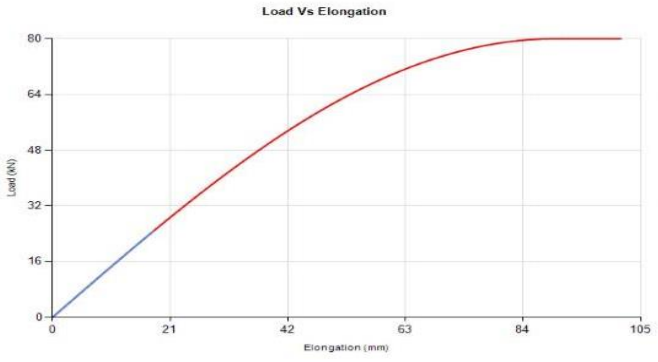
COMPONENT CERTIFICATION LAB

TEST REPORT

Test Report No.: 300 **Test Date:** 14-Dec-17 12:03:02 AM

TEST PARAMETERS

1. Reference Standard :	ROD
2. Docket No. :	Bss
3. Test Speed (mm/min) :	50
4. Test Sample :	SAMPLE ROD
5. Material :	MILD STEEL
6. Title of Test :	TENSILE
7. Sample ID No. :	J5216
8. Area (mm²) :	



TEST RESULTS

Sample No	Max. Load (N)	Max. Displacement / Stroke(mm)	Tensile Strength (N/mm²)	Elongation (%)	Measured Value of Test Piece		
					Thickness (mm)	Width (mm)	Length (mm)
1	80 kN	101 mm		101			
2	24.721 kN	17.5 mm		18			

Tested By,	Checked By,

EXCEL

EXCEL

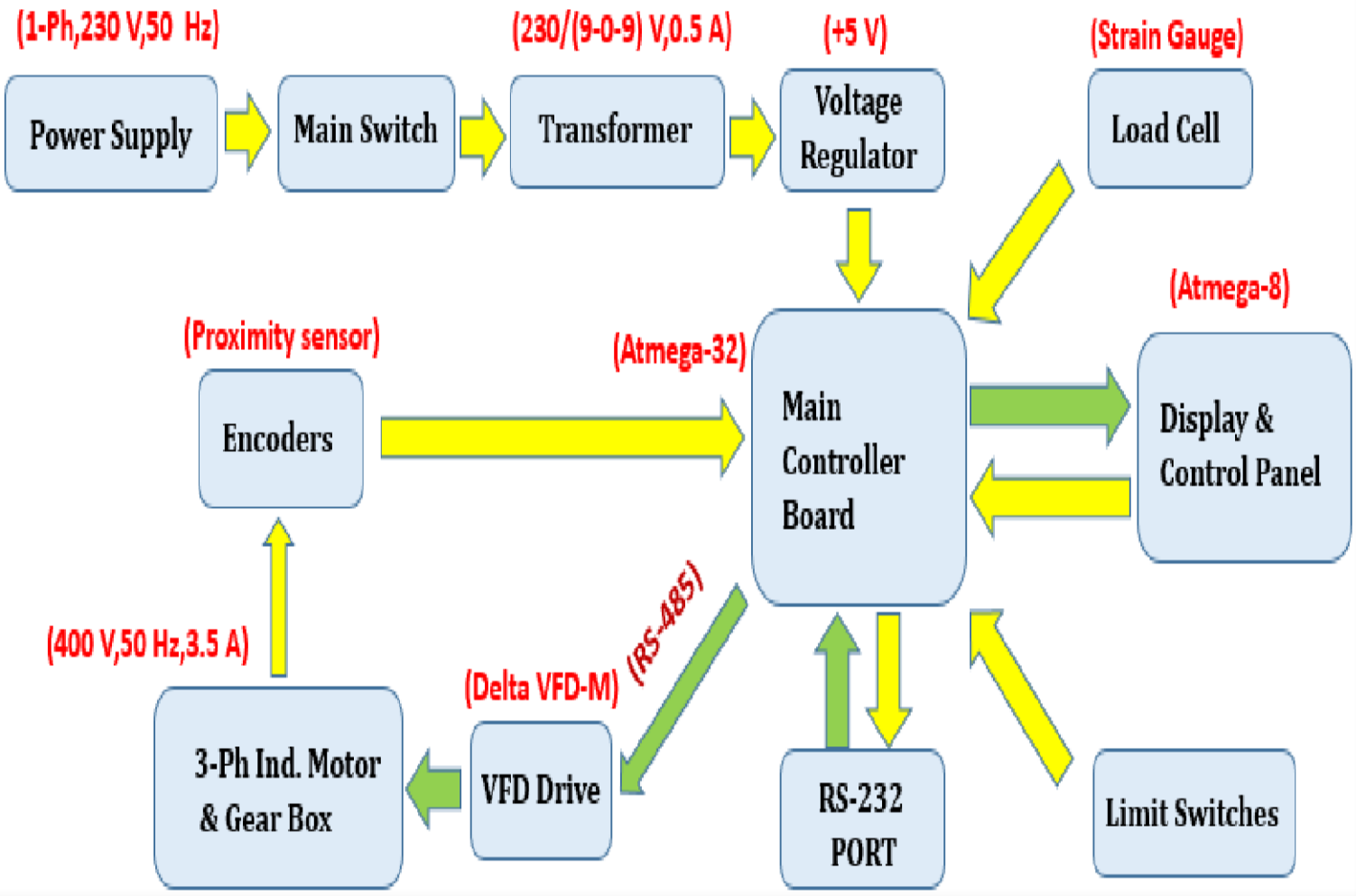
User save raw test data into excel file using this option. TEST

REPORT FORMAT

EXCEL ,PDF, WORD.

CONTROL PANEL

Block Diagram



Resonance Automation and machines Thermal testing machine is closely controlled for sensitivity, accuracy and calibration during every stage of manufacture. Machine is calibrated over each of its measuring range in accordance with the procedure laid down in as per tender specifications.

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talbros
Automotive Components

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SOMIC ZF Components Pvt. Ltd.

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energizing lives

Continental
The Future in Motion

Saxon Fluid Sealing Devices

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22 Quality co

Gun Carriage Factory
Jabalpur Recruitment

ODISHA POLICE

ADVANCED WEAPONS & EQUIPMENT INDIA LIMITED (AWEIL)