

P R E S E N T A T I O N

ON

INDIAN FRICTION MATERIAL ENGG. CO.

FRICMART[®]



URS is a member of Registrar of Standards (Holdings) Ltd.



FRICMART®

Products at a Glance



ISO / TS 16949 – 2009

Automotive Scheme



Certificate of Registration

This certificate has been awarded to

Indian Friction Material Engg. Co.
Plot No. C-41, Sector-B2, Tronica City Industrial Area, UPSIDC, Loni, Ghaziabad, Uttar Pradesh, 201102, India

in recognition of the organization's Quality Management System which complies with

ISO/TS 16949:2009

The scope of activities covered by this certificate is defined below

Design and Manufacture of Brake Pads, Brake Shoes and Liners

Certificate Number:	Date of Issue: (Original)	Date of Issue:
41411/B/0001/SM/En	13 September 2011	13 September 2011
Issue No:	Expiry Date:	IATF No:
1	12 September 2014	0126691

Issued by:  On behalf of the Schemes Manager





ISO 9001 – 2008

Automotive Scheme



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A PROFILE

- ◆ **FOUNDED ON** : ***18TH May 2006***
- ◆ **PLANT LOCATION** : ***Tronica City, Ghaziabad, U.P***
- ◆ **ON A 500 SQ.YARDS OF** : ***UPSIDC Industrial Area***
- ◆ **BUILT UP AREA ABOUT** : ***700 Sq.Yards***
- ◆ **PRODUCTION START UP** : ***May 2006***
- ◆ **EXCLUSIVELY FOR** : ***ASBESTOS - FREE BRAKE PADS,
BRAKE & CLUTCH LINERS***

- ◆ **INSTALLED CAPACITY**
- ◆ **(-) BRAKE PADS** : ***0.65 Million per Annum***
- ◆ **(-) LINERS** : ***0.55 Million per Annum***

- ◆ **EMPLOYEES AT PRESENT** : ***16***



PHASED PRODUCT RANGE

DESIGN , DEVELOP & MANUFACTURE	APPLICATION
--------------------------------------	-------------

✓ **PHASE-I** BRAKE PADS / BRAKE & CLUTCH LINERS
for M. CYCLES & PASSENGER CARS

PHASE-II BRAKE SHOES : *PASS. CARS*

PHASE-III BRAKE PADS : *RAILWAYS*

FOCUS AREA : *SPECIALIZED HIGH - TECH BRAKES*
(Wind Mill , Wedge Brakes, Sintered to Ceramic conversion)



FINANCIAL HIGHLIGHTS

- ◆ FIXED CAPITAL (2013) : Rs. 8.5 Million
- ◆ STATUS OF FIRM : S.S.I
- ◆ STATUS OF OWNERSHIP : PROP.
- ◆ TURNOVER - 2013 : Rs. 30 Million
- ◆ PROJECTED TURNOVER - 2014 : Rs. 45 Million



CORPORATE OBJECTIVE

- ◆ **PARTICIPATE IN INDIA'S FAST GROWING AND HIGHLY DIVERSIFIED AUTOMOBILE MARKET**
- ◆ **FOCUS ON SPECIALIZED HIGH TECH BRAKES** Like
Wind Mill , Wedge Brakes, Sintered to Ceramic conversion (Hummer)
- ◆ **AQUIRE & IMPROVE LATEST PRODUCT AND PRODUCTION TECHNOLOGY**
- ◆ **BE A RELIABLE SOURCE FOR OEM REQUIREMENTS**
- ◆ **DEVELOP STRONG CUSTOMER UNDERSTANDING THROUGH INTERACTION**



***Fricmart's* STRENGTH**

- ✓ **FLOW OF INFORMATION AMONG OVERSEAS CLIENT'S NETWORK , R&D LABS & INTERNATIONAL WORKSHOPS**
- ✓ **BACKED BY EXPERIENCE IN TURNKEY PROJECTS**
- ✓ **PLANNED AS ONE OF THE R&D HUBS AMONG OVERSEAS CLIENTS**
- ✓ **FOCUSSED ON 'NON-ASBESTOS NON TOXIC' PRODUCTS THRU. 4TH GENERATION' FORMULATIONS**
- ✓ **TECHNICAL PROWESS TO UNDERSTAND CUSTOMERS NEEDS AND DEVELOP SOLUTION ORIENTED APPROACH**



***Fricmart's* ENVIRONMENTAL OBJECTIVE**

- ❖ **INTEGRATE ENVIRONMENT ,HEALTH & SAFETY WITH BUSINESS DECISIONS**
- ❖ **DEVELOP GREENER ,EFFICIENT & `STATE OF ART' TECHNOLOGY AT AFFORDABLE PRICE**

CREATE PROMOTE SAFETY AWARENESS

- ◆ ***100 % ASBESTOS-FREE***
- ◆ ***100 % FREE OF TOXICANTS LIKE LEAD, CHROMIUM, ARSENIC AND ITS COMPOUND***
- ◆ ***WET / HYBRID PROCESS TO MINIMIZE DUST***



‘Designed to Cost’ Approach to OEMs

- ◆ **AWARENESS OF COST OBJECTIVE AT EARLY STAGE OF DEVELOPMENT**
- ◆ **PREPARE INITIAL *WISH LIST* FOR IMPROVEMENT OF EXISTING BRAKES OR DEVELOPMENT OF NEW MATERIALS**
- ◆ **CONDUCT MATERIAL SELECTION OF POTENTIAL FORMULATION**
- ◆ **PROGRAM BENCH TESTS / SIMILATION / PROVEN TESTS AND ANALYSE RESULTS**
- ◆ **PROPOSE SOLUTION AND ACT ON CUSTOMER FEEDBACK**



Fricmart's 4th Generation Formula Technology is based on the mechanism known as **T3B - *Tribological 3rd Body***

The formation of Micro structural Transfer Film or Friction Layer on the interface of friction partners (*ie.* Brake pad and Rotor) is known as ***Tribological 3rd Body*** (**T3B**)

T3B is chemically a Solid-Fluid mixture formed during translation of Kinetic Energy due to combined effect of Thermo-chemical & Plastic Deformation of friction partners.

The micro mechanical structure and properties of T3B plays important role in identifying the genesis of self excited friction vibration (*ie.* squeal / judder) due to phenomenon called `stick-slip`

®

Fricmart achieved this by its unique speciality *Additive PG-902*



Fricmart's Additive PG-902 is made in-house with unique blend of ***Polarized Graphite*** that not only posses good Lubricity but also exhibits extremely good Load Bearing ability and Anti Wear performance.

Unlike conventional additives, ***PG-902*** additive releases Electrically charged Micro Flakes with alternating +’ve and —’ve charges to form a continuous micro film /layer across the rotor/drum surface during wear-out process.

This Micro Film of *‘like molecules’* acts as physical separation between opposing surfaces ie. Brake pad & Rotor, protects the braking path from any damage and maintain consistent friction till the residual layer of Lining

There is neither a Sulfur effect nor Reaction products’ effect (stress corrosion of drum / rotor which are detrimental and common in conventional Linings) when Additive PG-902 plays the Major role as Tribological 3rd Body (T3B)

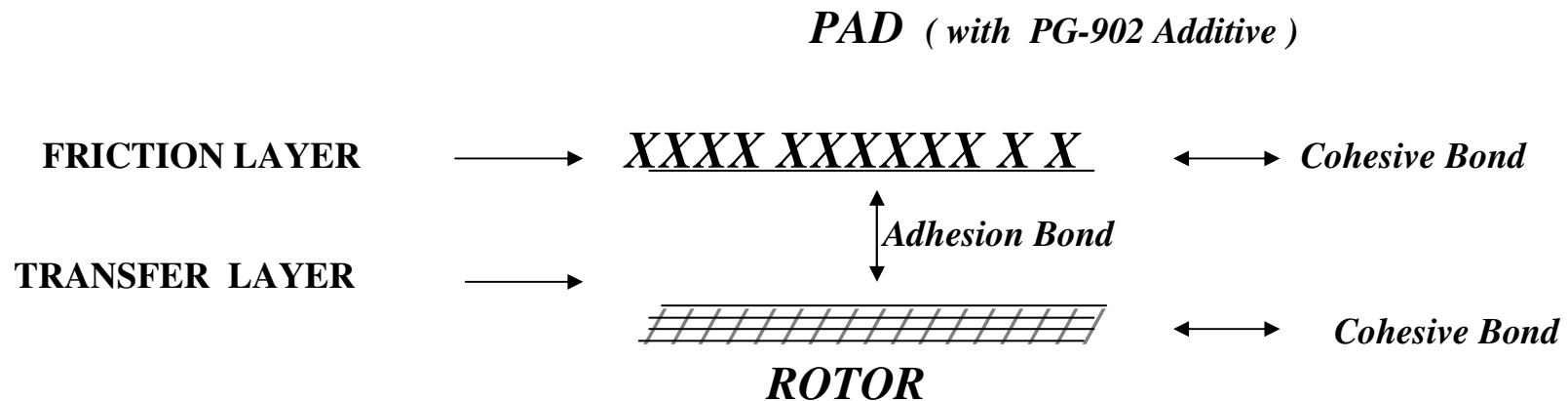
FRICMART[®]

®

Fricmart's POLAR GRAPHITE ADDITIVE PG-902

- (-) Helps in building special formation of `T3B` layer, a Protective Thin Transfer Film, Micro structurally tough with excellent adhesion to the metal surface.
- (-) Builds strong and durable "*Cohesive Bonds*" due to excellent `Visco- Elastic` property.

Illustration of Tribological 3rd Body (T3B)





Significance of 'T3B'

1. Because of long life of Transfer film, no new layer need to be formed very often from the friction composite. This resulted in 'low wear' of Pad / Lining.
2. Excellent 'adhesion' of Transfer film to the mating surface contributes to less wear of mating surface and thus protects rotor /drum from aggressive braking.
3. Stabilizes friction because of 'common origin' and 'like molecules' between transfer layer & friction partners thus minimizes variation between Static and Dynamic friction- μ to minimize 'Stick- Slip'. (*however a thick patch of transfer film is NOT preferable as it may cause judder*)
4. The quality of friction layer and transfer layer is responsible for stable friction, braking comfort (NVH) and wear life of friction partners.

Brake Drum after 'SAE J-661' Friction & Wear Test

Drum without T3B Layer



Figure 1. GLAZY DRUM WITH BLACK DUST

Drum with T3B Layer



Figure 2. MATT DRUM NO BLACK DUST



CHASE Test- SAE J-661

®

Pad with PG-902 Additive



Figure 3. FADE -III TEST @ 900 Deg.F

Krauss Test- ECE-R90

®

Pad with PG-902 Additive



Figure 4. DYNAMIC DRAG @ 950 Deg. F



Fricmart's Strength **MR. S.HABIB : Director-Technical**

Technocrat with more than 30 years experience in Friction Material Industry in R&D and Manufacturing.

- ◆ Associated in the past with American, Japanese and German Friction Material Joint Ventures in India.
- ◆ Took specialized training in R & D centers in Japan, Taiwan, Canada , Spain & China.
- ◆ Has wide knowledge and exposure in the latest ***4th Generation Asbestos-Free*** formulations, compounding & process and Testing .
- ◆ One of the founder Directors in M/s Indo German Brakes Pvt. Ltd, & M/s Neu Fricmart Pvt. Ltd during 2005 - 2010 .



Fricmart's Strength MR. R. RAJENDRAN : Director-Operations

Technocrat with more than 30 years of experience in Friction Material Manufacturing & Testing.

- ◆ Took specialized training in CIPET on composites, plastic & rubber technology.
- ◆ Associated in the past with American, Japanese and European Friction Material Joint Ventures in India with specialization in Railway Brakes.
- ◆ One of the founder Directors of M/s Neu Fricmart Pvt. Ltd during 2005 - 2009 and responsible for OEM approval of Brake & Clutch shoes in TVS Motorcycles Ltd.
- ◆ Has wide knowledge and exposure in Quality Management System as per ISO 9001 /TS 16949 / RDSO standards.



MR. SULTAN NAVID : (Executive – Testing & System)

- ◆ Graduate Engineer in Electronics, Instrumentation & Control has started his career in Plant Automation in Rockwell Inc.
- ◆ Has successfully trained in Testing & Evaluation of Friction Materials using computerized Physical, Mechanical and Tribology Testers.
- ◆ ‘On Line’ monitoring and control of all computerized Testers.
- ◆ Inter action with overseas Labs (TUV Lab) for proficiency Testing and Inter- Lab Testing .
- ◆ Implementation of NABL / ISO 17025 system in Test Lab accreditation.
- ◆ Periodical Calibration of Testing & Measuring Equipments.



REGISTERED MEMBER IN

- **COMPENDIUM on TECHNOLOGY EXPORTS (Friction Materials)
Deptt. Of Scientific & Industrial Research**
- **COMPENDIUM on TECHNOLOGY EXPORTS (Friction Materials)
Indian Institute of Foreign Trade**
- **DELHI CHAMBER OF COMMERCE**
- **INDIAN EXPORT IMPORT COUNCIL**
- **R.D.S.O (Ministry of Railways) – As approved supplier**
- **N.S.I.C – Delhi Chapter**
- **BUREAU OF INDIAN STD. - Transport Engg. Deptt.
Brake Committee (IS:2742- 1994 Automotive Brake Lining)**



TRAINING & CONFERENCES ATTENDED

- JAPAN BRAKE INDUSTRIAL CO. LTD, (JBI) Tokyo, Japan
- WU- TAI INDUSTRIAL CORP.(NABCO) Taipei, Taiwan
- EBRA FRICTION TECHNOLOGIE INC., Montreal , Canada
- FERS BRAKE COLLOQUIUM - Barcelona , Spain
- CHINA BRAKE COLLOQUIUM - Qingdo, China
- ECOLE POLYTECHNIC CONF. - Montreal, Canada
- UNIVERSITY OF TRANSILVANIA - Bucarest , Romania
- WORK SHOP ON FRICTION MATLS. - I.I.T , New Delhi



PAST EXPERIENCE OF *Fricmart's* KEY PERSONNEL

- *TVS -SUNDARAM BRAKE LININGS LTD*, Chennai
- *ALLIED NIPPON LTD* , Sahibabad
- *INDO GERMAN BRAKES LTD*, Dehradun
- *NEUFRICMAT PVT. LTD*, Coimbatore
- *REMSON BRAKES & CABLES LTD*, Pune
- *ESCORTS RAILWAY EQUIP. DIVN.* Faridabad



LIST OF INDIAN CUSTOMERS

❖ FOR BRAKES

- M/S SANDHAR AUTOMACH TECHNOLOGIES
- INDO GERMAN BRAKES PVT. LTD
- AMT BRAKES PVT. LTD

❖ FOR TESTING SERVICES

- M/s RANE BRAKE LININGS LTD
- ROULUNDS BRAKING INDIA LTD.
- TUV RHEINLAND ARABIA LLC.
- SIDDARTH BRAKES PVT. LTD
- SAINI BRAKE SYSTEMS (Defence Inspection)

❖ FOR BRAKE MIX /RAWMATERIALS

- M/s FEDERAL MOGUL INDIA PVT. LTD
- ESCORTS RAILWAY BRAKES DIVN.
- BONY POLYMERS LTD
- BIC (MASU) AUTO LTD
- RANBRO BRAKES INDIA LTD
- GRAYSHAM FRICTION PRODUCTS LTD



LIST OF OVERSEAS CUSTOMERS

- SAUDI GERMAN BRAKES MFG.Co. LTD, Jeddah, Saudi Arabia
- EBRA FRICTION TECHNOLOGIE INC., Montreal, Canada
- OYPAR OTOMOTIVES (RONDEX BRAKES), Istanbul, Turkey
- ASSOCIATED GASKET MFG. Co. LTD , Nairobi, Kenya
- FRICTION MATERIAL INDUSTRY srl. Aleppo, Syria
- COSELI, S.A , Iasi, Romania
- PHOENIX INDUSTRIES SRL. Bucarest, Romania
- LUDAL BRAKES MFG. CO. LTD, Bulgaria
- SCH INDUSTRIES INC. Thailand
- RAZAK MOTORS , Sri Lanka



COMPOUNDING & MIXING EQUIPS.

Sl. No.	Name of Equipment	Year	Supplier
1	Plough Share Mixer- 600 litres	2006	AH Engg. Works, Delhi
2	Plough Share Mixer- 120 litres	2002	AH Engg. Works, Delhi
3	Prototype Lab Mixer- 60 litres	2007	Filtromix , Bombay
4	Rubber Kneader Mixer- 45 lit	2010	Slach Hydraulics, Delhi
5	Rubber Roll Mill - 12 " x 36 "	2010	
6	Micro Pulverizer - 24 "	2003	AH Engg. Works, Delhi
7	Micro Pulverizer - 12 "	2003	AH Engg. Works, Delhi
8	Vibratory Screening m/c	2003	AH Engg. Works, Delhi
9	Blender Stirrer	2005	Remi , Bombay
10	Electronic Platform Scale - 150kg	2003	Essae Teraoka
11	Electronic Bench scale- 6 kgs	2009	Essae Teraoka
12	Electronic Bench scale- 3 kgs x 3 nos.	2009	Essae Teraoka



MOLDING & FINISHING EQUIPS.

Sl. No.	Name of Equipment	Year	Supplier
1	Hydraulic Press- 200 Tons	2006	Standard Hydraulics, Delhi
2	Hydraulic Press- 150 Tons	2006	Standard Hydraulics, Delhi
3	Hydraulic Press- 80 Tons	2006	Jyoti Hydraulics, Delhi
4	Hydraulic Press- 70 Tons	2006	Naresh Engg. Faridabad
5	Rotary Hydraulic Press- 30 ton	2008	Automech Engg., Ghaziabad
6	Electrical Box Oven	2008	Dipole System, Gurgaon
7	Shot Blasting Tower	2006	Adarsh Fabricator, Faridabad
8	Rotary Surface Grinder	2007	Precision Engg, Delhi
9	Surface Grinder - vertical	2006	Precision Engg, Delhi
10	Belt Sander	2006	Grind Tools, Pune
11	Multi slitting m/c	2009	Precision Engg, Delhi
12	Powder Coating System	2008	Dipole System, Gurgaon
13	Pad printer- manual type	2008	Print Line systems, Faridabad
15	Dust Collectors -02 nos.	2006	Adarsh Fabricators, Faridabad
16	Generator - 35KV	2006	Sukhdev Engg. Works, Delhi
17	Generator- 10KV	2005	Sukhdev Engg. Works, Delhi
18	Compressor - 5 H.P	2007	Sukhdev Engg. Works, Delhi
19	Central Thermic Fluid Heating System capacity - 2000kcal.	2006	Alfa Therm (Thermax) Delhi

PHYSICAL & MECHANICAL LAB EQUIPS.

Sl. No.	Name of Equipment	Year	Supplier
1	Rockwell Hardness Tester	2006	Krystal Elmec, Miraj
2	Shore Hardness Testers –A / D	2011	Hiroshima, Japan
3	Digital Tensometer - 2500N	2011	Asian Test Equips,Gzbd.
4	Digital UTM - 20 Ton	2011	Krystal Elmec, Miraj
5	Shear Tester - 10 Ton	2007	Neutech , Chennai
6	DIN Abrasion Tester	2011	Asian Test Equips, Gzbd.
7	Silent Block Endurance Tester	2011	Sc Dey & Co, Kolkata
8	Torsion / Stiffness Tester	2012	Sc Dey & Co, Kolkata
9	Electronic Density Balance	2007	Essae Teraoka, Bangalore
10	Digital Vernier , Micrometer	2011	Mitutoyo , Japan



CHEMICAL LAB EQUIPS.

Sl. No.	Name of Equipment	Year	Supplier
1	Electronic Analytical Balance	2011	Advance Scientifics, Gzb.
2	Muffle Furnace - 1000 deg.C	2009	Advance Scientifics, Gzb.
3	Hot Air Oven - 300 deg.C	2009	Advance Scientifics, Gzb.
4	Hot Plate , Mandle Heater	2009	Advance Scientifics, Gzb.
5	Soxhlet Apparatus , Water Bath	2009	Advance Scientifics, Gzb.
6	PH Meter	2011	Advance Scientifics, Gzb.
7	Melting Point Apparatus	2011	Advance Scientifics, Gzb.
8	Particle size Test kit	2007	Advance Scientifics, Gzb.
9	Misc. Analytical apparatus, Glasswares etc.	2007	Advance Scientifics, Gzb.



POLYMER LAB EQUIPS.

Sl. No.	Name of Equipment	Year	Supplier
1	Toxicity Chamber (Defence Std.)	2011	Asian Test Equips, Gzbd.
2	Limiting Oxygen Index Tester (Defence Std.)	2011	FEC India, New Delhi
3	Flammability Tester (Defence Std.)	2011	FEC India, New Delhi
4	Smoke Visibility Tester (Defence Std.)	2011	FEC India, New Delhi
5	Cold Chamber - minus 40 deg C (Defence Std.)	2011	FEC India, New Delhi



TRIBOLOGY (FRICTION) LAB EQUIPS.

Sl. No.	Name of Equipment	Year	Supplier
1	F.A.S.T - Friction & Wear Tester as per GM / FORD stds	2006	Greening Inc. USA Reburbished by PPE, Chennai
2	CHASE -Friction & Wear Tester as per SAE J661/ BIS / /ISO/JASO stds.	2006	Krauss GmbH, Germany Reburbished by PPE, Chennai.
3	KRAUSS -Friction & Wear Tester as per ECE R-90 std.	2010	Krauss GmbH, Germany Reburbished by PPE, Chennai.



EVOLUTION OF ASBESTOS-FREE PADS *at a glance*

- **ALL VEHICLES IN DEVELOPED COUNTRIES ARE FITTED WITH ASBESTOS -FREE PADS / LININGS**
- **ABOUT 30 YEARS OF R&D HAS SIGNIFICANTLY IMPROVED THE PERFORMANCE OF ASBESTOS -FREE FRICTION MATERIALS FAR BEYOND THOSE OF ASBESTOS**
- **HARDLY ANY RESEARCH ON ASBESTOS FRICTION MATERIALS IN THE LAST 30 YEARS**
- **TIME HAS COME TO CHANGE TO ASB-FREE, DESIGNED TO IMPROVE UPON AND REPLACE ASBESTOS**
- ***Fricmart* IS COMMITTED TO FURTHER ADVANCEMENT OF ASBESTOS - FREE TECHNOLOGY FOR OEMs**

EVOLUTION OF 4TH GENERATION PADS

A. HISTORY :

- | | |
|---------------------------------------|---------------------------------|
| ❖ 1 st GENERATION ASB.FREE | - SEMI METALLIC- HIGH STEEL |
| ❖ 2 nd GENERATION ASB.FREE | - SEMI METALLIC-MEDIUM STEEL |
| ❖ 3 rd GENERATION ASB.FREE | - ORGANIC N.M / LOW STEEL |
| ✓ 4 th GENERATION ASB.FREE | - ORGANIC- NON STEEL (CERAMICS) |

B. CONSTRUCTION :

Category	Steel %	Other Fibre%	Fibre : Organic Ratio	Fibre : Lube Ratio	Fibre : Filler Ratio
❖ SEMI METAL- HIGH	40 - 60	0	1.2 : 1.0	1 : 1	2 : 1
❖ SEMI METAL- MEDIUM	25 - 40	0 - 5	1.0 : 1.5	1 : 1	1 : 2
❖ ORGANIC/ LOW STEEL	15 - 25	15 -20	1.0 : 2.0	3 : 1	1 : 1
✓ CERAMICS	0 - 10	5 -10	1.0 : 1.0	1 : 1	1 : 1
(ASBESTOS)	(50-60)		(1.8 : 1)	(20 : 1)	(8 : 1)

EVOLUTION OF 4TH GENERATION PADS

C. SIGNIFICANT FEATURES:

1. SEMI METAL- HIGH STEEL -- COMPROMISED ASBESTOS LAYER USED TO PROMOTE ADHESION . HARD, ROTOR DTV, METAL DEPOSIT, POOR WET FRICTION
2. SEMI METAL-MED.STEEL -- LOW SHEAR, HEAT TRANSFER TO BRAKE SYSTEM, ROTOR DTV, BLACK DUST
3. ORGANIC NON METAL -- LOW CONDUCTIVE, HEAT SWELL HIGH ENERGY BRAKE FADE , SPEED / PRESSURE SENSITIVENESS
- ✓ 4. CERAMICS (4TH GEN.) -- GOOD NVH BEHAVIOUR INSENSITIVE TO SPEED / PRESSURE CONSISTENT FRICTION & EXTENDED LIFE

EVOLUTION OF 4TH GENERATION PADS

U.S.A

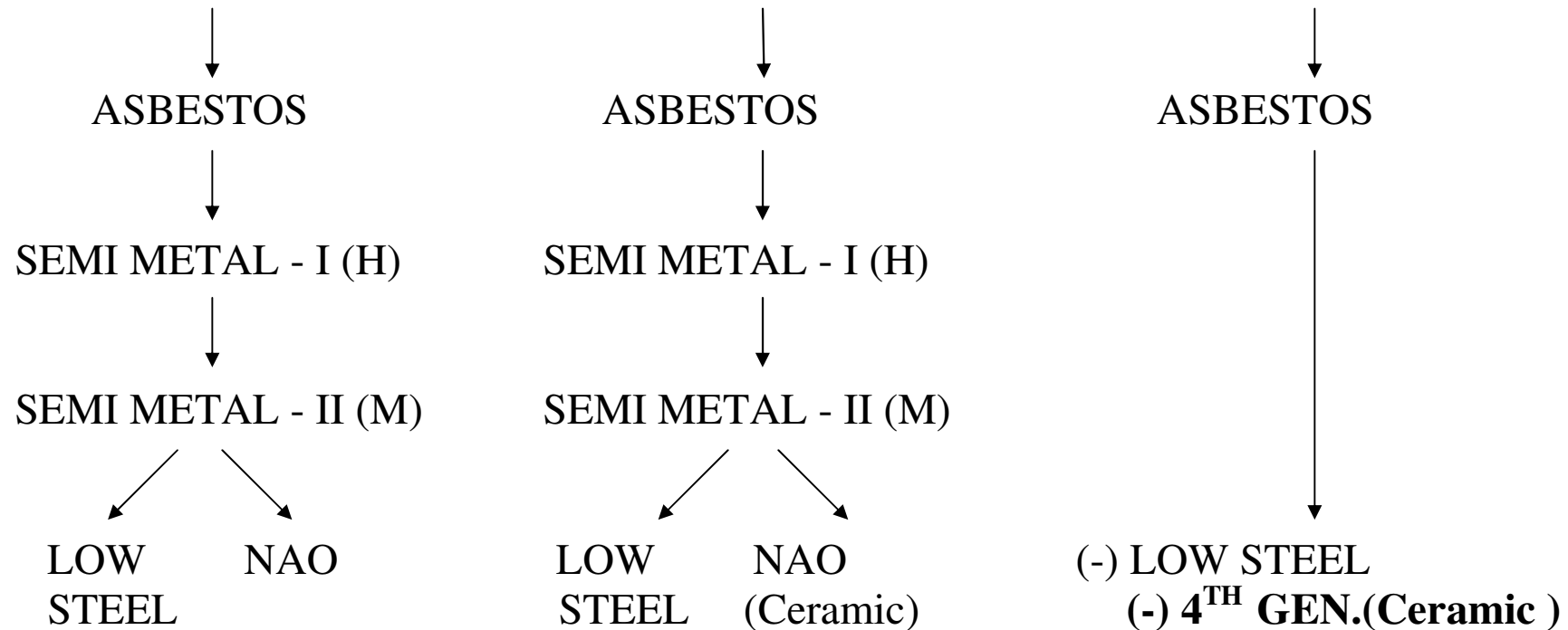
JAPAN

EUROPE

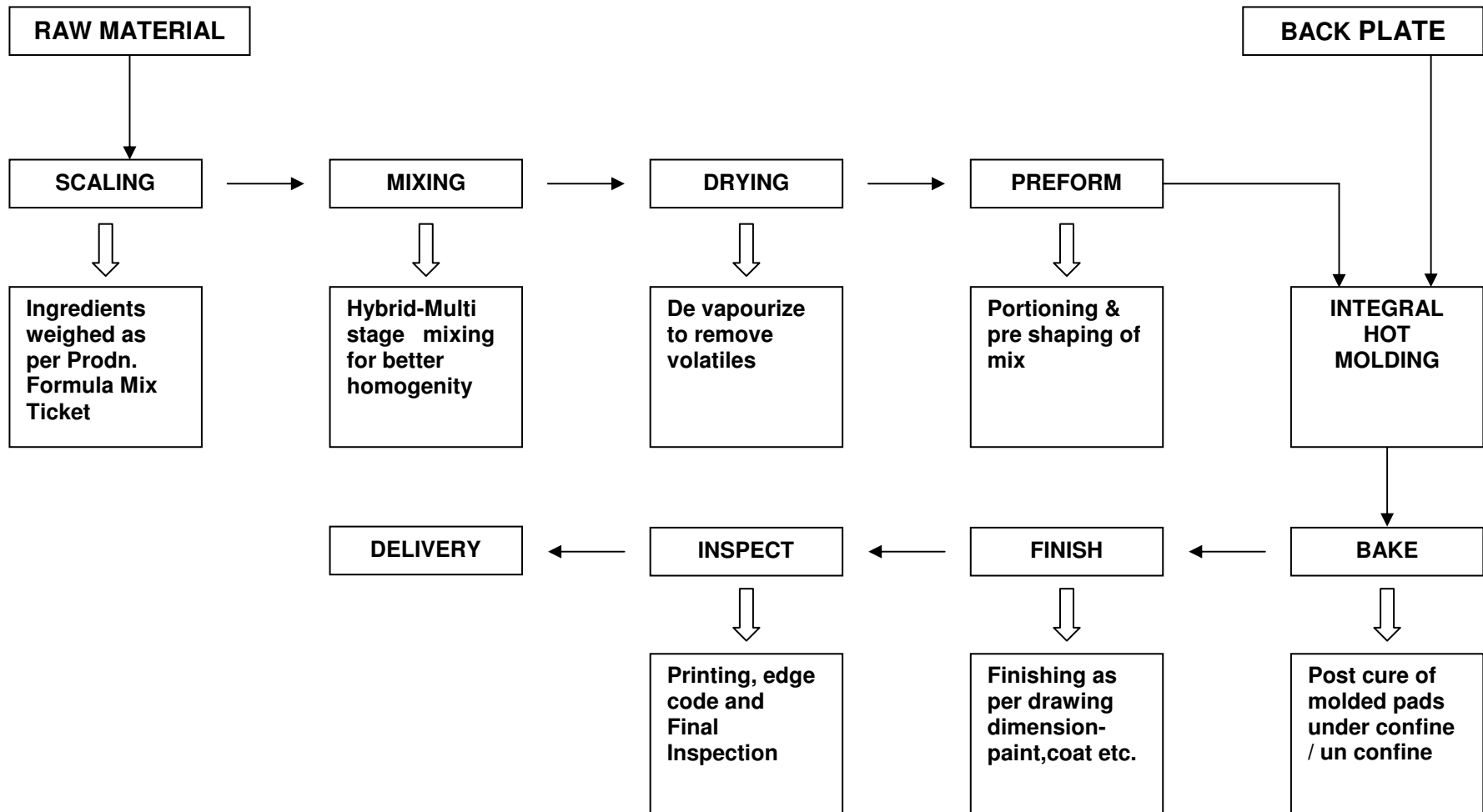
(Mu: 0.30 – 0.35)

(Mu: 0.30 – 0.35)

(Mu: 0.35 – 0.50)



PROCESS FLOW CHART - 4th GENERATION PADS



FRICMART[®]

***4th GEN. ASBESTOS-FREE PADS
ADVANTAGES***

A. SALIENT FEATURES

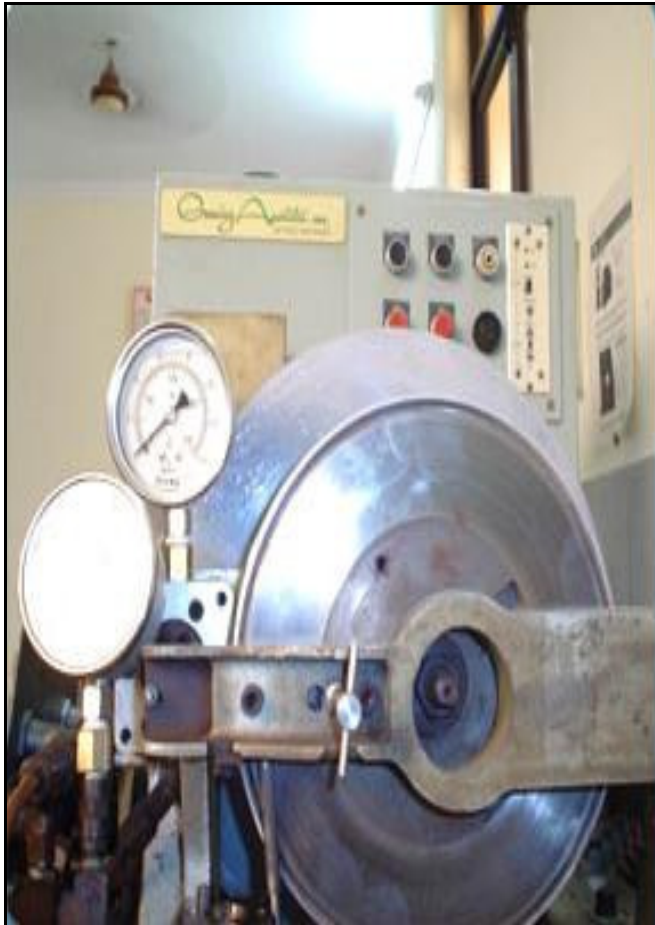
- ◆ NOT JUST PERFORMANCE ADVANCEMENTBUT
- ◆ ECONOMICAL OPERATING COST
- ◆ COMFORT FACTORS ARE FOCUSED RESPECTING OPERATORS & DRIVERS VIEWS

Fricmart's 4TH GENERATION Pads have

- ◆ MICRO STRUCTURE ADVANTAGE..... ***THE PAD TOPOGRAPHY***
- ◆ MICRO MECHANIC ADVANTAGE..... ***THE TRIBOLOGICAL 3rd BODY***
- ◆ OPTIMIZED SURFACE RESILIENCE.... ***THE MATRIX REFINEMENT***

FRICMART®

Tribology Lab – F.A.S.T Tester



FRICMART®

FRICITION ASSESSMENT & SCREENING TEST (FAST)

CONSTANT FRICTION MODE , HEAVY DUTY PROCEDURE

Operator Name : Sultan

Test Date : 10 Jan 2012

Test No. : 130

Date of printing : 10 Jan 2012

TEST CONDITION

DISC MATERIAL -- BRAKE IRON
SURFACE MICROINCH -- 15-20
SLIDING VELOCITY -- 23 FPS
FRICTION FORCE -- 17.25 LB
SPECIMAN AREA -- 0.5 SQ.IN

Product Name : B-Pad/Cera-03

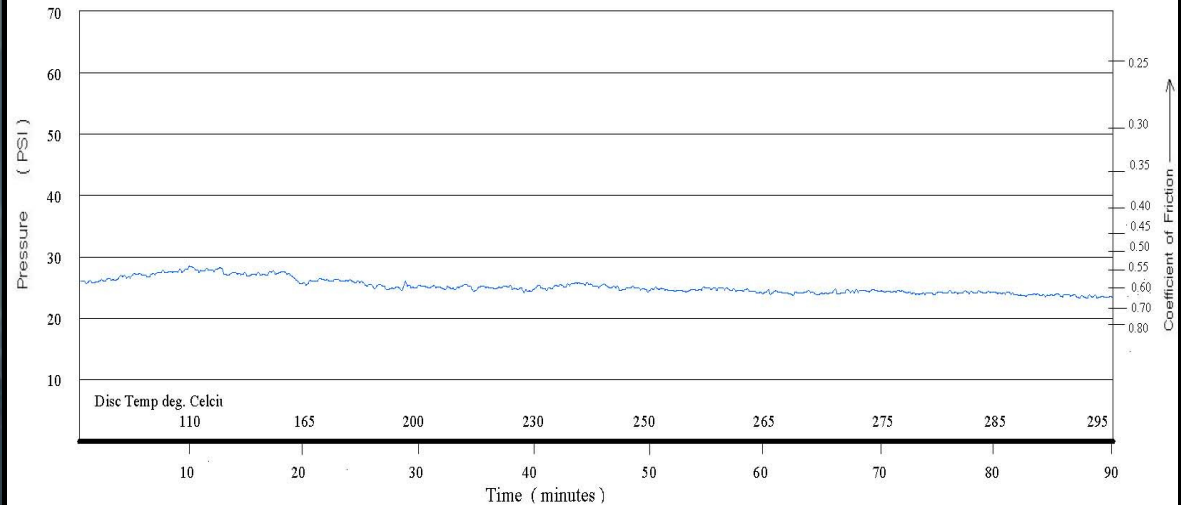
Supplier : R&D

Batch No. : 0112

Wear Rate : 0.0167 IN³/HP-HR

Specific Gravity : 2.9

Cubic Inches Wear : 0.0088



Tribology Lab – CHASE Tester



FRICMART[®] INDIAN FRICTION MATERIAL ENGG. CO.

SAE J661 Graph Friction Coefficient Test Rig

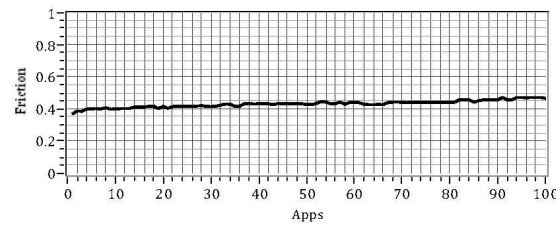
Login Details

Test Name	131	Lot	213-12
Part No	Brake Pad CERA	Customer	Q C D
Grade	9600 H	Operator	Sultan
Batch No	Jan2012	Test Date	1/14/2012

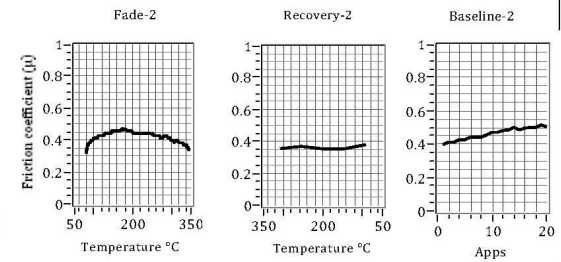
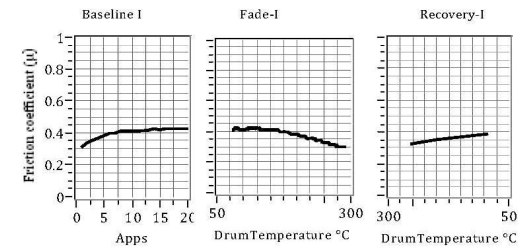
Wear Data

	Mass(gm)	Thick(mm)
Initial	9.440	2.90
Final	9.060	2.55
WearLoss	0.380	0.35
Wear %	1.900	5.80

Wear



Load=667 N



Tribology Lab – KRAUSS Tester



FRICMART[®] Constant Speed Dynamic Test Rig - ECR 90 Test Report
Graphical Report-Pressure Mode

Test ID: <input type="text" value="504"/>	Engineer: <input type="text" value="Sultan"/>	Customer: <input type="text" value="R&D"/>	Effective Radius: <input type="text" value="97.250"/> mm
Grade: <input type="text" value="Signal"/>	Date: <input type="text" value="01/01/10"/>	Remarks: <input type="text" value="QC-Type"/>	Cylinder Area: <input type="text" value="20.428"/> sqcm
Part No: <input type="text" value="Brake Pad"/>	Vehicle Model: <input type="text" value="WAGON-R"/>	Caliper Type: <input type="text" value="B134"/>	No of Pads: <input type="text" value="2"/>

Temperature in C vs Applications

μ Performance	<input type="text" value="0.375"/>	μ Min	<input type="text" value="0.261"/>
μ Recovery	<input type="text" value="0.431"/>	μ Max	<input type="text" value="0.482"/>
μ Fade	<input type="text" value="0.261"/>	%Fade	<input type="text" value="30.405"/>
		%Recover	<input type="text" value="114.984"/>

Friction Coefficient vs Applications

WEAR

	Pad 1	Pad 2
Initial Thickness in mm	<input type="text" value="14.58"/>	<input type="text" value="14.69"/>
Final Thickness in mm	<input type="text" value="14.16"/>	<input type="text" value="14.40"/>
Thickness Loss in mm	<input type="text" value="0.42"/>	<input type="text" value="0.29"/>
% Loss Thickness	<input type="text" value="2.88"/>	<input type="text" value="1.97"/>
Initial Weight in gm	<input type="text" value="199.58"/>	<input type="text" value="198.86"/>
Final Weight in gm	<input type="text" value="198.02"/>	<input type="text" value="197.86"/>
Weight Loss in gm	<input type="text" value="1.56"/>	<input type="text" value="1.00"/>
% Loss	<input type="text" value="0.78"/>	<input type="text" value="0.50"/>

'SILENT' MATERIAL DEVELOPMENT

CRITERIA	TRADITIONAL FRICTION MATERIAL DEVELOPMENT	LATEST FRICTION MATERIAL DEVELOPMENT
PARAMETERS CONSIDERED	FOCUSSED ON FRICTION & WEAR BEHAVIOUR ONLY. NOISE & COMFORT TESTS GIVEN PRIORITY AT A LATER STAGE OF DEVELOPMENT	INTERGRATION OF PERFORMANCE & COMFORT BEHAVIOUR FROM THE BEGINNING OF DEVELOPMENT
DEVELOPMENT METHODS & TOOLS	MOSTLY EMPIRICAL	EMPIRICAL & ANALYTIC USING STATE OF THE ART LAB & EQUIPMENTS
LATER STAGE OF DEVELOPMENT PROGRAM	NOISE TEST PERFORMED AS SPECIAL TEST OFTEN ONLY ON VEHICLES	NOISE TEST PERFORMED AS ROUTINE TEST USING BENCH TESTERS

‘SILENT’ MATERIAL DEVELOPMENT

PROJECT STAGE	TEST RIG - FAST (Ford / GM std.)
MATERIAL DEVELOPMENT	TEST RIG – CHASE (IS / SAE / ISO / JASO)
APPLICATION ENGINEERING	KRAUSS FRICTION TESTER (ECE- R 90)
CUSTOMER APPRAISAL	DYNO / VEHICLE (JIS std.)

BRAKE NOISE RESEARCH SYSTEM

SCOPE

TEST SCHEME

CHARACTERISTICS

EQUIPMENT

ACOUSTIC MEASUREMENTS

1. DRIVE TEST

TONE QUALITY
RESONANCE OF BRAKE
AND BODY

NOISE METER

DRIVE TEST NOISE
DYNO NOISE
1) Mu level

FREQUENCY ANALYSER

VIBROMETER

2. NOISE DYNO TEST

2) Mu / V
FINDINGS OF
RESONANCE

NOISE DYNAMOMETER
SLOW SPEED
FRICTION TEST RIG

GENESIS OF BRAKE NOISE

1. FRICTION MATERIAL

PHYSICAL PROPERTIES

- 1) Compressive Elasticity
- 2) Viscous damping coeff.
- 3) Plastic deformation

COMPRESSIVE TESTER

VISCO ELASTIC METER

THERMAL EXPANSION
APPARATUS

FRICTIONAL DATA

- 1) Mu level
- 2) Mu / V

SLOW SPEED TEST RIG

KRAUSS TESTER
INERTIA DYNO

PAD TOPOGRAPHY

- 1) Formation of Tribological
3rd body on Pad surface
- 2) 3rd body on Disc surface

OPTICAL MATRIX
ANALYSER

2. MULTI BODY - OCILLATOR
BRAKE COMPONENTS

RESONANCE

BRAKE NOISE RESEARCH SYSTEM

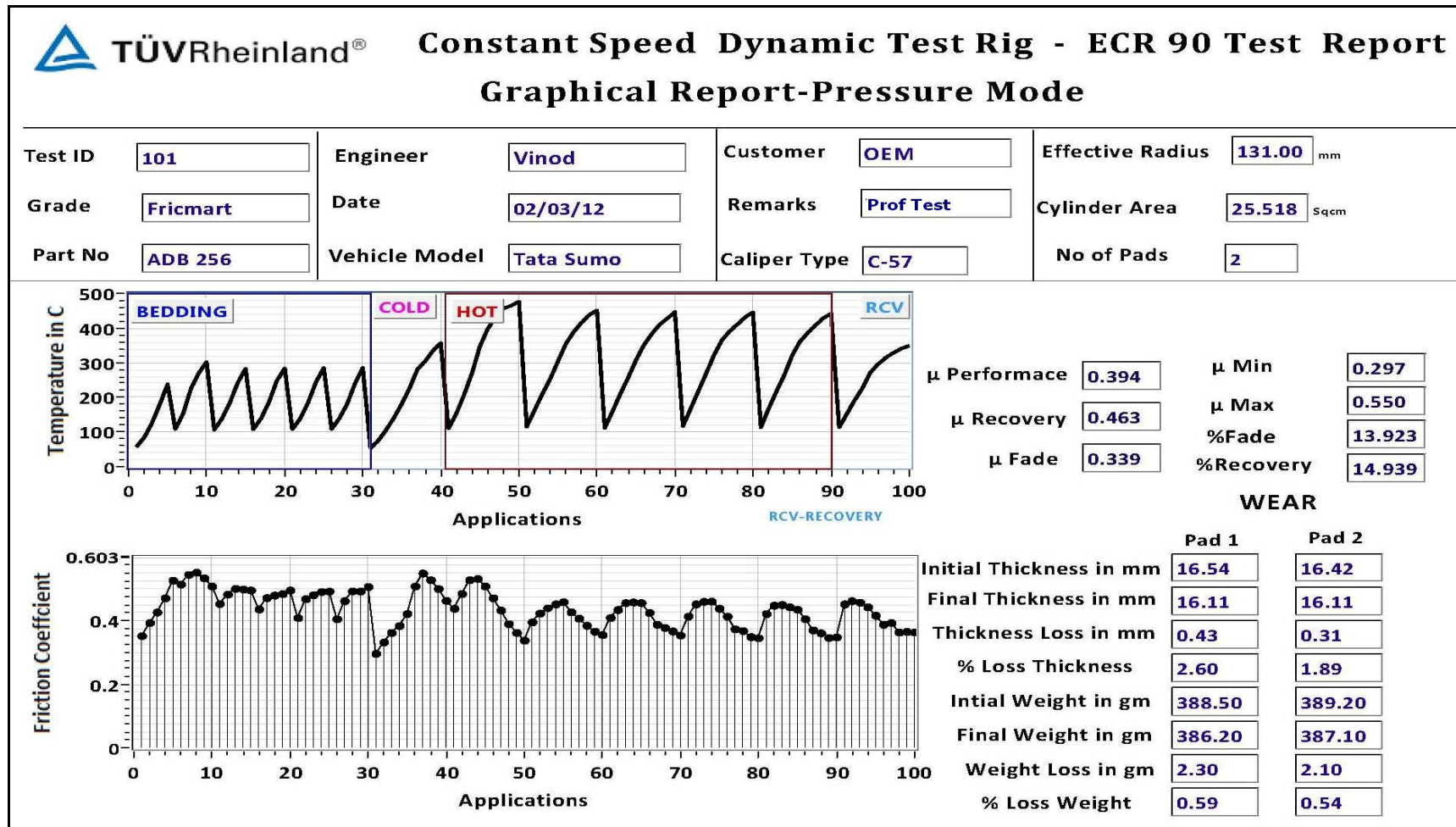
NOISE Vs ROTOR COMPOSITION

Components

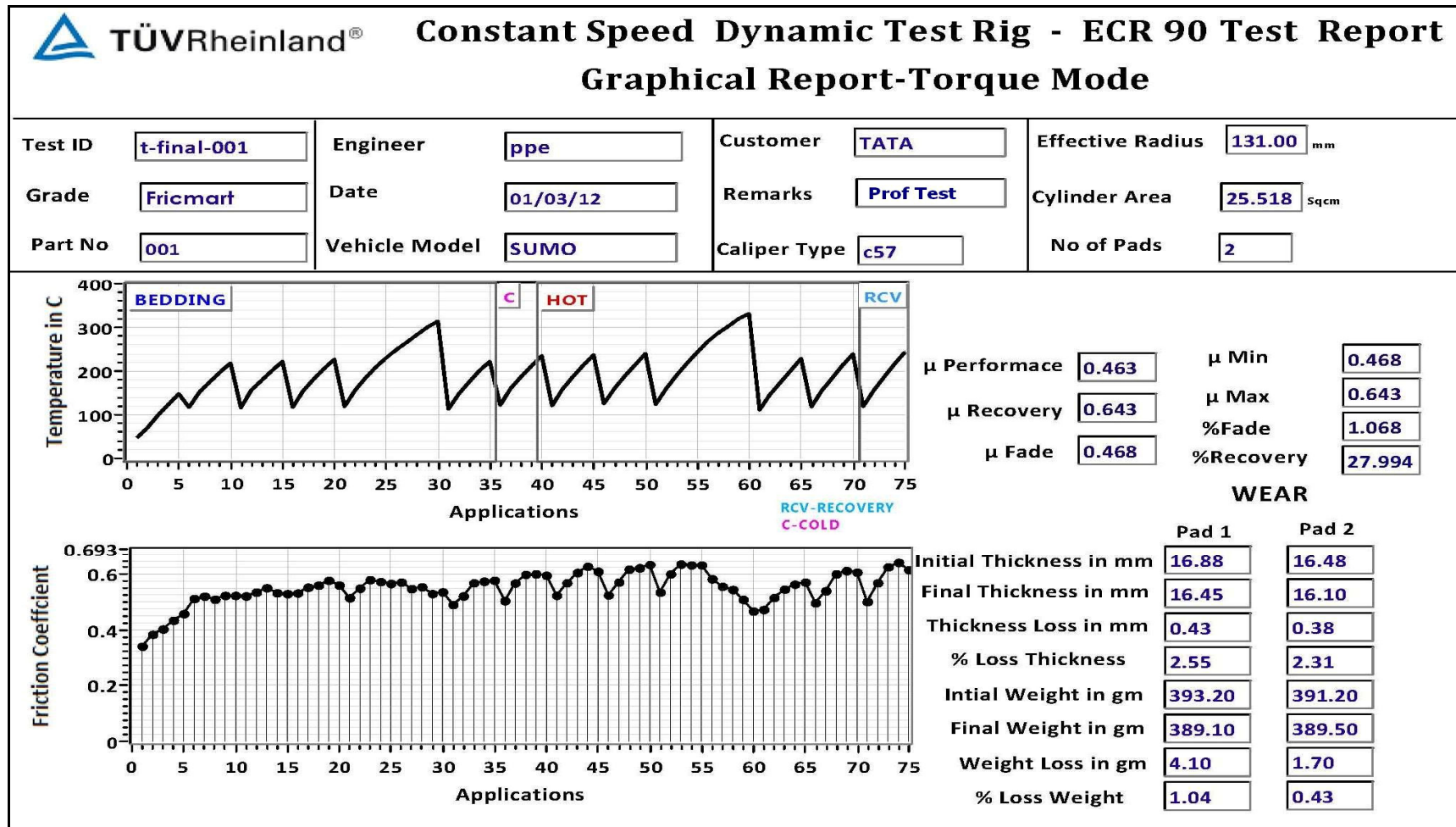
	CE	TC	Si	Mn	P	S	Cr	Cu
ROTOR- A	3.95	3.27	2.05	0.48	0.06	0.14	0.06	0.07
ROTOR- B	3.96	3.29	2.02	0.72	0.03	0.04	0.16	0.04
ROTOR- C	4.89	4.02	2.63	0.73	0.10	0.13	0.32	Tr

Note: Rotor 'C' proved to have Good NVH behavior.


Fricmart's Pads Tested at TUV Lab

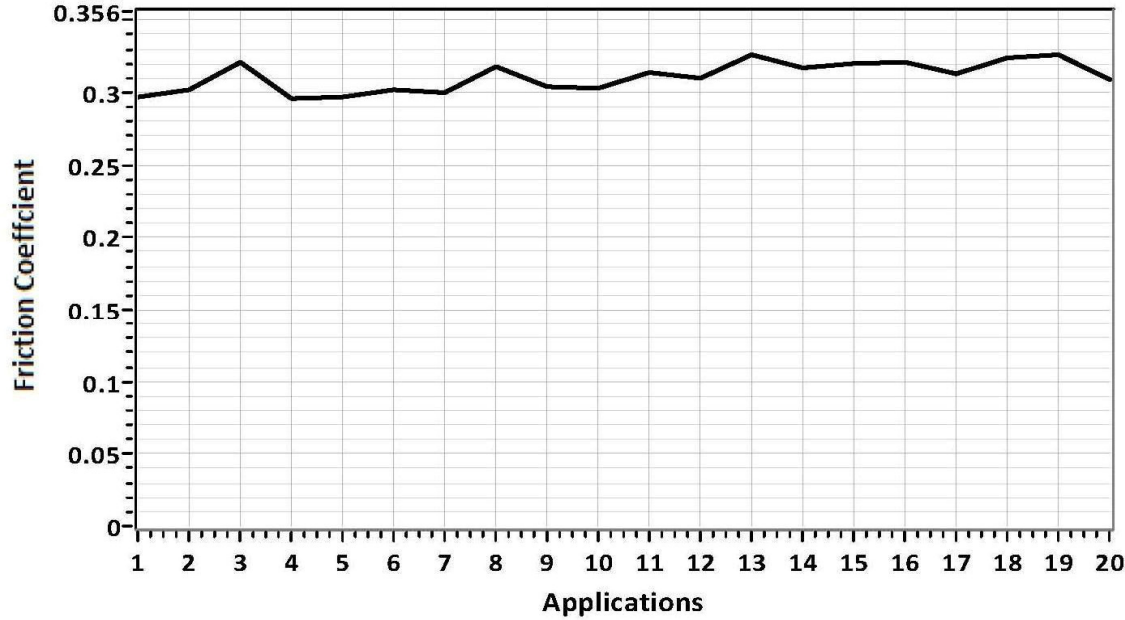


Fricmart's Pads Tested at TUV Lab



Fricmart's Pads Tested at TUV Lab

 TÜVRheinland® Constant Speed Test Rig - Static Test Report					
Test ID	<input type="text" value="105"/>	Engineer	<input type="text" value="vinod"/>	Customer	<input type="text" value="oem"/>
Grade	<input type="text" value="Fricmart"/>	Date	<input type="text" value="02/03/12"/>	Remarks	<input type="text" value="Prof Test"/>
Part No	<input type="text" value="ABD568"/>	Vehicle Model	<input type="text" value="TATA sumo"/>	Caliper Type	<input type="text" value="c57"/>
		Effective Radius	<input type="text" value="131.000"/>	mm	
		Cylinder Area	<input type="text" value="25.518"/>	Sq cm	
		No of Pads	<input type="text" value="2"/>		



μ Min	<input type="text" value="0.296"/>
μ Max	<input type="text" value="0.326"/>
μ Average	<input type="text" value="0.311"/>

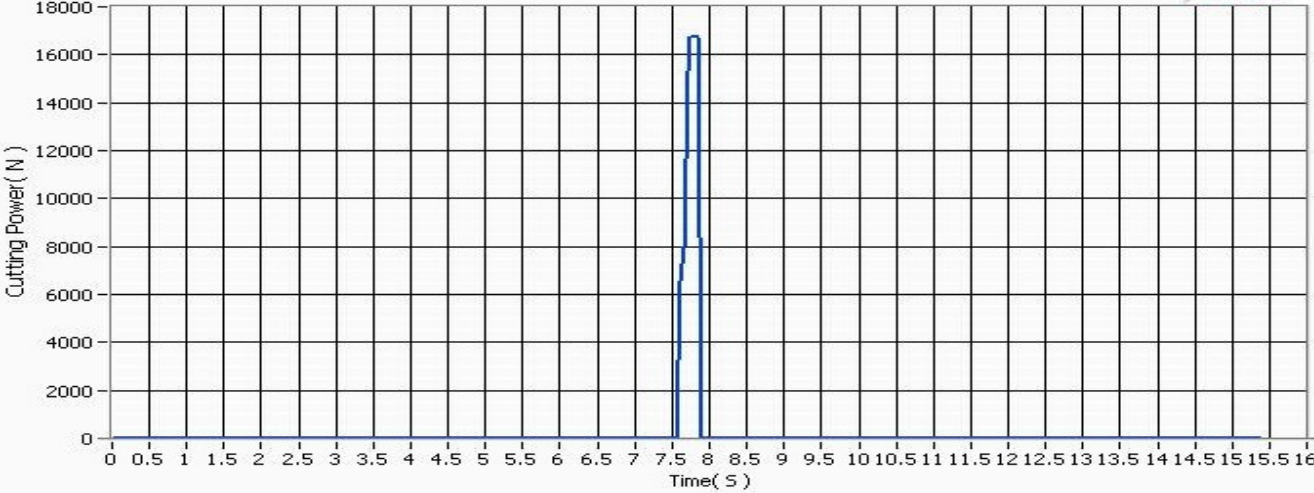
Fricmart's Pads Tested at TUV Lab

14:01:09
11/07/2012

CUTTING CAPABILITY TEST REPORT

<p>Date: <input type="text" value="2/07/2012"/></p> <p>Sample Type: <input type="text" value="Brake Pad"/></p> <p>Article No.: <input type="text" value="Indica"/></p> <p>Batch No.: <input type="text" value="Lx 343 May12"/></p> <p>Manufacturer: <input type="text" value="Fricmart"/></p>	<p>Standard: <input type="text" value="ISO 6312"/></p> <p>Load speed: <input type="text" value="4500"/> N/s</p> <p>Sample area: <input type="text" value="33"/> cm²</p> <p>Max. cutting power: <input type="text" value="16720"/> N</p> <p>Cutting Strength: <input type="text" value="506.67"/> N/cm²</p>
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Test Commences at:



Choose

Print

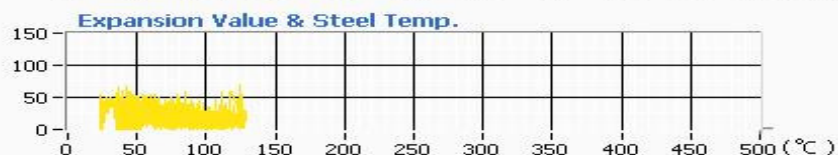
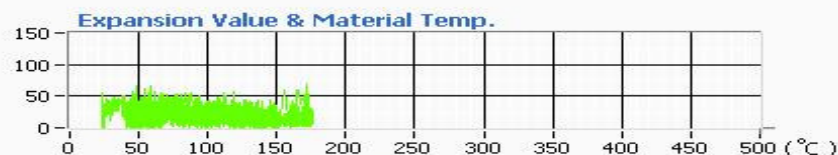
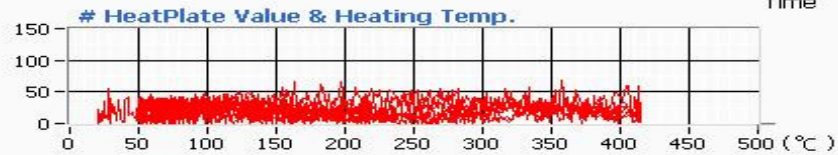
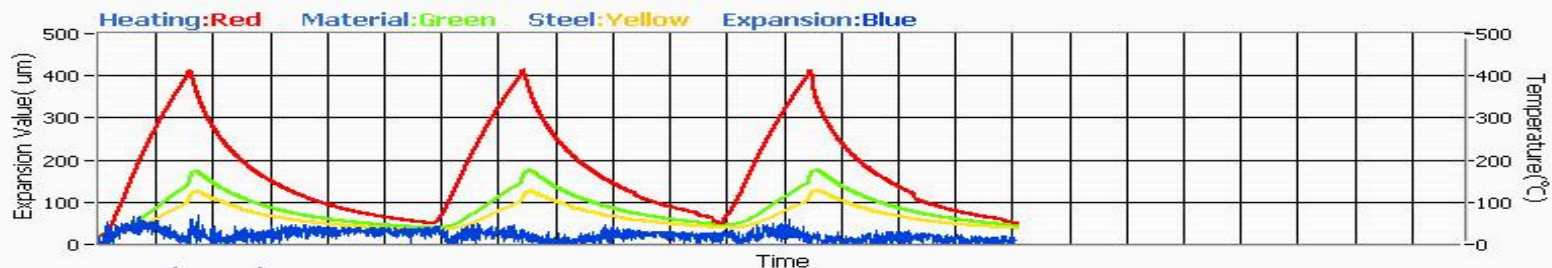
Exit

Operator: _____
Sanction: _____

Fricmart's Pads Tested at TUV Lab

HEAT EXPANSION TEST REPORT

Date: 6/07/2012 Thickness: 15 mm Times: 3
 Sample Type: brake pad-Indica High Temp.: 400 °C Heating Time: 15 Min
 Department: Fricmart Low Temp.: 50 °C Batch No: Lx 343 may12



Expansion Test Data Form

Item Cycle	Expansion Value Max. (um)	Temperature of ValueMax (°C)	High Temp. Expansion. (um)	Residual Expansion. (um)
1	69.1	357	8.47	37.5
2	48.0	242	13.1	9.76
3	58.1	333	18.9	16.5
Average	58.3	310.7	13.0	20.7
Expansion Percentage (%)			0.43	

Test Commences at: 8:30

Operator: _____

Sanction: _____

Fricmart's Pads Tested at TUV Lab

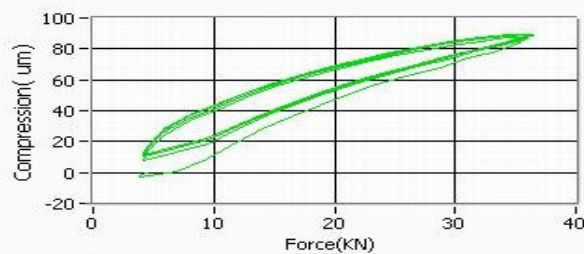
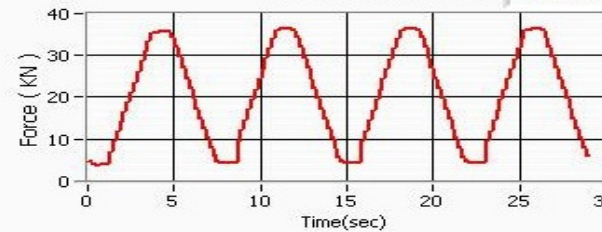
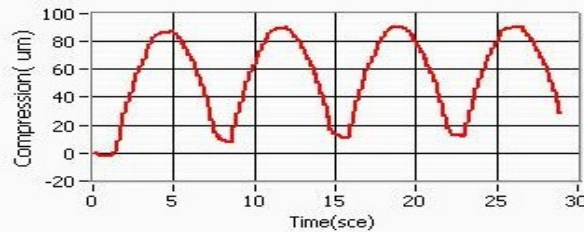
COMPRESSIBILITY TEST REPORT STANDARD ISO6310-Procedure A

12:45:51
11/07/2012

Date: 09/07/2012
 Sample Type: Brake Pad
 Article No.: T-Indica
 Batch No.: Fricmart Lx-9600
 Operator: Binod
 Result: 92 um

Preload: 0.5 MPa
 Area of Sample: 33.00 cm²
 Thickness: 16.53 mm
 Temperatur: Normal °C
 Loading Rate: 4 MPa/S

Test commences at: 12:58



Cycle	P (MPa)				Comp.R. (%)
	1	2	4	8	
1	-2	0	40	86	0.54
2	0	8	49	91	0.57
3	0	11	50	92	0.57
4	0	12	51	92	0.57
Average	-0	8	48	90	0.56

Choose Print Exit

Result: 92 um

Fricmart's Pads Tested at TUV Lab

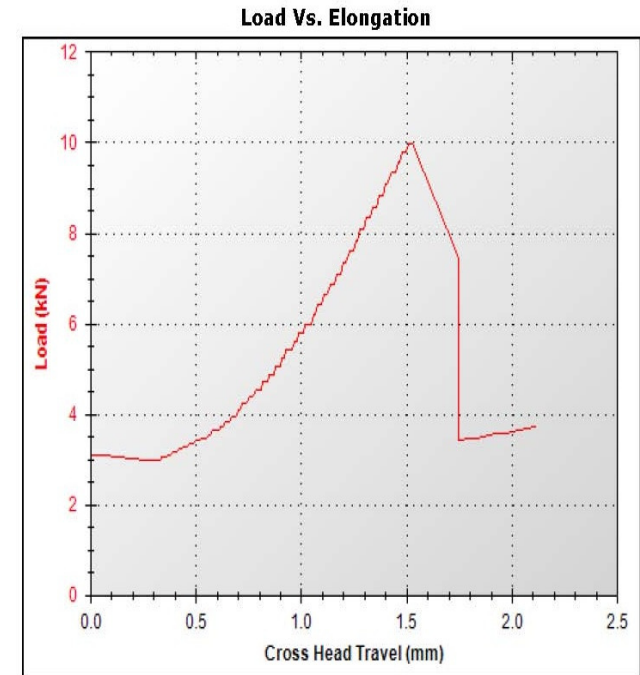
TUV Rheinland Arabia LLC

P.O. Box 51834, Jeddah Saudi Arabia

Single Shear Test Report

Machine Model : TUE-C-200	Test File Name : JULY2012(5).Utm
Machine Serial No. : 2010/24	Date : 7/7/2012
Customer Name : FRICMART	Customer Address : TronicaCity, UP, India
Lot Number : 231	Test Type : Single Shear
Order Number : 674	Heat Number : 235

Input Data	Output Data
Specimen Shape : Flat	Load at Peak : 9.96 kN
SpecimenType : Tubular Product	Elongation at Peak : 1.760 mm
Specimen Description : Brake Lining	Shear Strength : 61.179 N/mm ²
Specimen Width : 20 mm	
Specimen Thickness : 8.14 mm	
Pre Load Value : 0 kN	
Max. Load : 200 kN	
Max. Elongation : 200 mm	
Specimen Cross Section Area : 162.8 mm ²	



Tested By : admin



End of Presentation

“Thank U”

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