FOURESS
ENGINEERING (INDIA) LIMITED
In the business of flow

GAS TIGHT ISOLATORS

Diverter Damper for Gas Turbine Exhaust

Louvre Damper for FGD Application

Hydraulically Operated Gas Biasing Damper

Guillotine Gate Damper for Gas Turbine Exhaust

HIGH INTEGRITY **DAMPERS** FOR HIGH TEMPERATURE **GAS ISOLATION / CONTROL**

Glandular Guillotine Isolator

General

Glandular valves are designed to provide 100% shut-off gas ducts in continuous process plants. They provide complete isolation of ancillary equipments, even against pressure excursions, allowing safe access for on-load inspection or maintenance, without having to close down the main process. Unscheduled emergency outages due to auxiliary equipment troubles can therefore be eliminated.

3000mmx 3000mm Glandular Guillotine Isolator supplied to Ansaldo, Italy

Guaranteed 100% Gas tightness

Fouress Glandular valves consist of a steel plate sliding between the proven Fouress Glandular sealing system. As the blade, in the closed position, extends beyond the seals on all four sides into atmosphere, the valves are 100% gas-tight across the blade, ensuring completely safe isolation of the duct.

Single Drive

For differentials +100 to -500mm H_20 and temperatures around 300^{0}C, the blade consists of a thin plate, larger than the duct cross-sectional area, which is withdrawn completely from the seals into atmosphere when the isolator is opened. For ducts smaller than 9m^2 in cross section a design with a single drive is available.

Sealing efficiency: 100% on CSA without seal air

Duty: On/Off

Double Drive

Glandular guillotines are also available in Double Drive, to suit the duct sizes more than 9M2 in cross section and duty conditions of differentials +100 to -500 mm H_2O and temperature around 300^{0}C with Motor/Actuator and Gearbox.

In this design also, blade consists of a thin steel plate larger than the duct cross sectional area which is withdrawn completely from the seal into atmosphere when the isolator is opened.

Sealing efficiency: 100% on CSA without seal air

Duty: On/Off

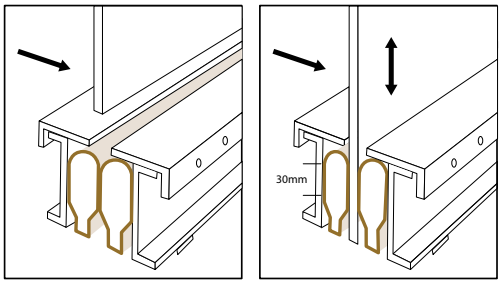
Glandular Guillotine Isolators for ESP Inlet/ Outlet at 2x660 MW Jaypee Negri Power Plant

Dust Clearance

These isolators are particularly suitable for dusty conditions because when open or closed the area of blade in contact with the seals is never exposed to the gas stream. Furthermore the blade on entry has a self cleaning action as it slides through any dust build-up

Sealing System

Located around the complete insides of the isolator's duct frame are are one or two sets of flexible metallic looped sealing elements. The seals, giving a positive metal to metal seal of atleast 30mm width, whether the isolator is open or closed, maintain a constant seal between the duct and the atmosphere. As the blade extends into atmosphere, beyond the seals, on all four sides of isolators using the sealing system are 100% gas-tight across the blade.



Operating Gear

The entire valve operating gear is located outside the duct and does not come into contact with the flue gases. The critical components, such as the motor, drive shaft, gear boxes and drive screws can therefore be inspected and serviced at all times. This ensure that even after long periods of inactivity, the valve will function properly and not, itself, be the cause of a plant outage.

Size: Fouress Glandular vlaves are available for duct sizes upto 100m^2. They are suitable for square, rectangularand with the addition of end plates, circular cross-sections

Guillotine Isolator

General

Fouress Guillotine Isolators are designed to provide 100 % Gas tightness with Seal air barrier (Duplex) or 99.95 % on CSA without Seal Air barrier (Simplex) for high temperature gas ducts for safe access isolation of Boiler auxiliaries.

Size

Fouress Guillotine Isolators are available for duct sizes up to 100m2. They are suitable for square, rectangular and, with the addition of end plates , circular cross- sections.

Gas Conditions

Fouress Guillotine Isolators are capable of being designed to withstand temperature upto 650 Deg C and pressure differences upto 2000mm WG .

Blade Entry

Fouress Guillotine Isolators are suitable for isolation in horizontal, vertical and inclined ducts. The blades can be arranged to enter from the duct above (top entry) , from below (bottom entry) form the side or at any inclined angle.

Unenclosed

For positive differentials and gas temperatures below 3000C the blade is withdrawn from the duct to atmosphere past an entry door which closes behind it to seal off the live duct. This arrangement facilitates on-load inspection and servicing of all parts of an isolator.

Sealing efficiency: 99.95% on CSA without seal air. 100% with seal air.

Duty: On/Off

Enclosed

For high positive/negative differentials, where gas leakage to atmosphere during transit cannot be tolerated, or where temperatures exceed 3000C, the blade is withdrawn into a gas tight casing. This ensures that the blade remains at near duct temperature thereby preventing temperature distortion occuring when it is operated. Arrangements for on-load inspection and servicing of the blade and its seals can be provided, while it is always available for the operating gear which is located externally.

Sealing efficiency: 99.95% on CSA without seal air. 100% with seal air.

Duty: On/Off

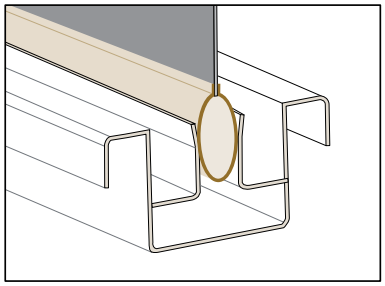
Dust Clearance

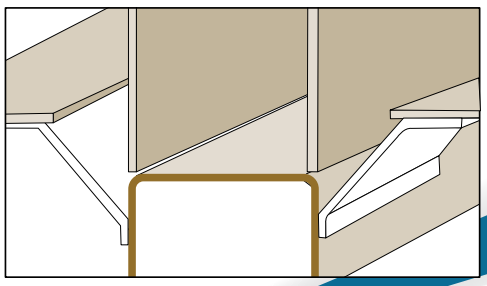
Where dust accumulations can be expected a flue dust clearance door is provided in the base of the duct framework to ensure smooth operation of the isolator.

Sealing System

OPTION A (SEAL ON THE BLADE) Fitted to the periphery of the blade is a series of flexible metallic looped and leaf-springs sealing elements. These are designed to seal against both continuous landing bars in the duct framework of the unit and to provide a sealing margin of at least 30mm. The metallic seals alone, give a sealing efficiency of 99.95% or better, on cross-sectional area (SIMPLEX). Where 100% gast-tightness is required a fan is used to create a pressurised air barrier in the interspace between the two sealing faces (DUPLEX).

OPTION B (SEAL ON THE FRAME) Flexible Flat Metal Line Sealing System is provided on the frame to ensure 99.95% or better on cross-sectional area (SIMPLEX). When 100% gas-tightness is required a fan is used to create a pressurised air barrier in the interspace between the two sealing faces. (DUPLEX)





Louvre Dampers

Multiflex (Multi Louvre) Damper with Hastalloy-C Liner – FGD plant at JSW , Ratnagiri

Duplex Louvre Damper with Poly Glass Lining – Reliance Dhahanu FGD Plant

Multiflex

A balanced multi-louvre damper giving a sealing efficiency of 99.95% or better on cross-sectional area. This design is ideal for use where regulation of the gas flow is required in conjunction with an ability to seal off a duct reasonably tight, and where, due to temperature or corrosion risks, special seal materials are required.

Insulated Frame: For Internally lined ducts, units are provided with a dual frame, where the internal frame can move relative to the external frame without affecting the sealing efficiency.

Loss Motion Linkage: With the sliding linkage the shafts are connected to each other in a manner so as to nullify the effects of differential expansion. This avoids the risk of a loss in sealing efficiency due to blade rotation and prevents seizure due to expansion of the frame relative to the blades.

Sealing efficiency: Multiflex units use the same leaf-spring sealing system as flap isolator. Single row of seal (SIMPLEX) ensures 99.8% leak-tightness on CSA and Double row of seals (DUPLEX) with air barrier provides 100% leak-tightness.

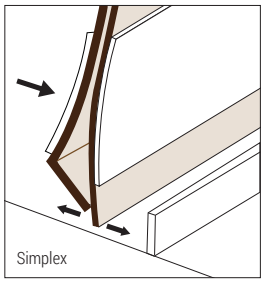
High Temperature Bearings: This specially designed self lubricating maintenance free gun metal bearing

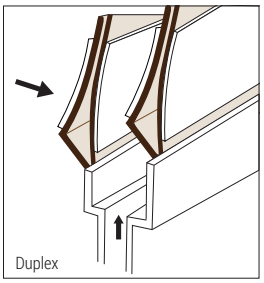
1. Is self aligning as it is connected to the bracket by a flexible stainless steel diaphragm.

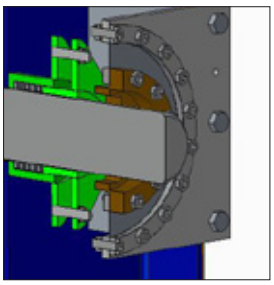
2. The large free surface, in combination with the small volume of the diaphragm and the low temperature conductivity of the material makes the diaphragm a temperature barrier between the bracket and bearing.

3. The shaft seal consists of a flat disc, fitting tightly over the shaft, which is pressed against the isolator's frame by a flexible metallic cone and steel collar.

This gives a positive metal to metal seal between the shaft and frame without inhibiting the self alignment capabilities of the bearings or causing excessive friction torque as can happen with traditional packed glands.







Low leakage Louvre: A balance single/multiple blade dampers for regulation or On/Off duty, designed for trouble free operation

The dampers are of contacting type to ensure sealing efficiency up to 98% on CSA. Linkages are so designed that each blade can be adjusted independently. Dampers are available in parallel blade or opposed blade construction.

Bearings are mounted outside the flow path and are specially designed to avoid jamming due to dust and thermal distortion.

Duty: On/ off and Control

Flap Isolators

General

Most systems , handling gas, require sections to be isolated for maintenance without shutting down the complete plant. Hitherto in sophisticated plants, thus has been achieved by using gate valves. Fouress Flap isolators now offer a simpler and cheaper solution without any loss in sealing efficiency. In particular they

(a) Require less external space and no special precautions against wind loading.

(b) Can be supplied in modular form, allowing easy installation in large ducts

(c) Need no external supports when installed in vertical or horizontal ducts.

Sealing Efficiency

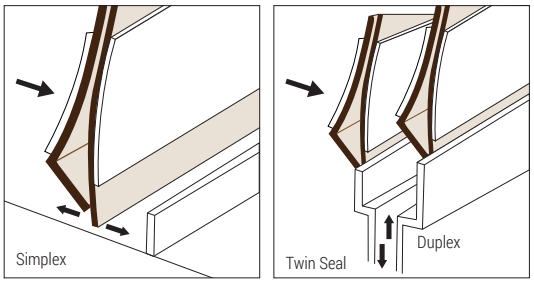
Flap isolators with a single row of seals give a sealing efficiency of 99.98%, or better, on cross-sectional area. To obtain access to an isolated section, without needing a blanking plate, 100% isolation can be provided by using a second row of seals. In the interspace a peripheral air barrier is created by, either a small fan (DUPLEX) or, venting to atmosphere (TWINSEAL)

Seals: Fitted to the periphery of the blade(s) or frame are flexible metallic leaf-spring sealing elements. As the blade closses the spring deflects to give a comprehensive metal to metal seal of at least 20 mm width. The seal normally is in the direction of the pressure gradient but there is sufficient stiffness in the seals to accommodate specified levels of reverse pressure. The damped cantilever design ensures that the seal is completed in a single flat plane and protects the seal against flutter and subsequent fatigue.

Duty: On-Off/Regulation

Twin Seal Flap Isolator: Safety and reliability have been a challenge in today's coal fired boilers at thermal power stations. Fouress, in technical consultation with a few discerning customers developed the perfect solution to the pressing problem of effective Isolation of PF mills. This has been done with the ingenious concept of Twin Seal Flap (TSF) Isolator which guarantees 100% sealing efficiency for safe access to on-load maintenance in PF Mills

Sealing system: The TSF Isolator is provided with double row of seals, made of superior SS 316 material. Each row of sealing system provides 99.99% or virtually 100% sealing efficiency on cross sectional area. Care is taken to ensure that leakage from the first row of seal is discharge into the atmosphere through a vent valve thereby ensuring 100% tighness across the duct. The sealing system is suitable for pressures up 2000mm WG and temperatures of about 650^{0}C. The seal consists of a thin metal leaf strip predeflected by a bias spring. The seal strip is pressed agains the landing surface forming a flat 20mm wide sealing surface around the blade periphery. The operational deflection of the sealing element is about 17mm and it can tolerate upto 12mm misalignment without any decrease in sealing efficiency. In the open position the seal is prevented from fluttering by a support plate against which the seal strip is held by the bias spring.



High Temperature Bearings: The bearing incorporates a unique design concept:

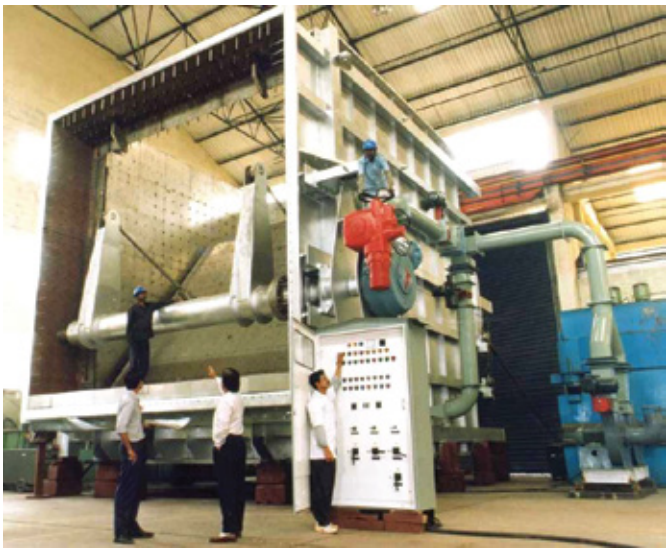
• It consists of a self lubricated maintenance free gun metal bush mounted in a concentric ring which is in turn connected to a mounted plate by a flexible stainless steel diaphragm

• The simple design allows the central bearing system to deflect angularly besides providing the self-aligning capability

• The shaft seal comprises of two split annular or ring like flexible metallic discs. These are mounted on machined housing fixed to the inside of the frame, held in place by a stainless steel plate, enabling the gland seal to float to accommoadate shaft movement

Diverter Dampers

Most gas handling systems have a requirement to change the gas flow direction to allow access to critical components, without shutting down the whole plant. With traditional dampers there is the danger of an upset or explosion, if the two dampers do not act simultaneously. Fouress Diverter Valve was developed to handle such a situation in gas-turbine installations which incorporates a heat recovery boiler. Subsequently, the concept has been used in a wide variety of industrial applications such as refinery heat recovery plants, pollution control and nuclear ventiation systems and D.G. sets.



Why a diverter?

- Improve boiler efficiency by reducing heat losses through a dump stack or by-pass
- Permint 'On-Load' maintenance of waste heat boilers, gas turbines and fans.
- Ensure maximum plant safety by preventing both gas paths from being shutoff simultaneously
- Increase plant efficiency by minimising back pressure through the isolator
- Increase plant flexibility by allowing easy and safe switching between boilers and/or turbines

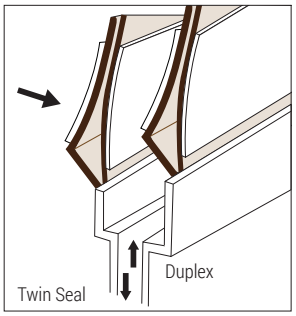
Key Features

Floating 'Blade' Assembly • Insulation on both outer 'Blade' surfaces • Minimal differential expansion in the 'Blade' • Pressure assisted 'Blade' seals • High basic Sealing Efficiency • Integrally stiffened Plenum • Suitable for external or internal insulation • Pressure assisted metal shaft seals • Self aligning bearings • Completely external drive system

Fouress Flexible Metallic Seal

The Fouress seal consists of a thin metal leaf strip (1) predeflected by a bias spring (2) the seal strip is pressed against the landing surface (3) forming a flat 20mm wide sealing surface around the blade periphery. The operational deflection of the sealing element is about 17mm and it can tolerated upto 12mm misalighment, without any decrease in sealing efficiency. In the open position the seal is prevented from fluttering by a support plate (4) against which the seal strip is held by the bias spring.

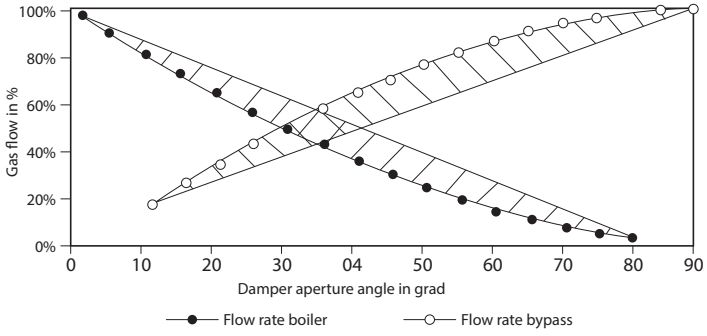
Duplex: To attain accessto an isolated section, without the need for a blanking plate, 100% isolation can be provided using a double row of seals. In the interspace a peripheral air barrrier is created by a small fan, ensuring that any gas leakage is positively barred. In the event of a pressure surge or fan failure the fan ducting acts as a vent to atmosphere, enabling personnel to evacuate the isolated section.



High Temperature Bearing

Regulation:

Fouress Diverter Valves are designed with a sufficiently high natural frequency so that they can be held indefinitely, under normal conditions, at any intermediate position. This they can be used to regulate the gas flow, even at full load. The graph shows the flow characteristic for a typical gas turbine waste heat boiler application. The precise curve for each case is however dependent on the system layout and equipment parameters.



Exhaust System for GT Combined Cycle Plants

Total GT Exhaust System executed by Fouress for GE Frame 9E Gas Turbine at AES Kalinitissa, Srilanka (168 MW CCPP) through L&T, Mumbai

Total GT Exhaust System executed by Fouress for Siemens V942 Turbine at BAPL, Samalkot 230MW CCPP through BSES, Noida

The Exhaust system is installed between the gas turbine exhaust and the HRSG in a Combined Cycle Gas Turbine plants (CCPP). The Exhaust System consists of Diverter Damper (Changeover Valve), Guillotine Isolator, Bypass Stack with silencer, Expansion joints, inter-connecting transition Ducts and Support Structures etc for Gas turbines of all makes & models as shown in the sketch.

DIVERTER DAMPERS: Primarily used in Gas Turbine (GT) plant in-between GT exhaust & HRSG, a diverter is designed with one inlet and two outlets (towards HRSG & Bypass). The blade pivots from one end rotating 90 Degrees to close one of the outlets. These dampers are used to divert the exhaust flue gas of GT either to HRSG or to By-pass stack side. The flow can be diverted either partially or fully.

GUILLOTINE DAMPER: Though, the philosophy of diverter envisages 100% isolation of HRSG, for maintenance and statutory inspection (IBR in India), the factory inspection authorities insist on a 'visible' closure device like gate damper for 'man-safe' access to boiler (HRSG). A Guillotine damper invariably forms an isolation device behind the diverter. Ideally, these are bonneted duplex guillotines with (bulb) seals and seal air fan for pressurizing seal cavities.

In fact, Diverter Dampers and Guillotine Dampers for Combined cycle power plant have been our core products since 1986 with the first technical license from M/s Metro-Flex of Switzerland and later from M/s Hermann Rappold & Co GmbH, Germany. Under this technology transfer/collaboration, Fouress supplied number of Diverters and Guillotines for combined cycle and co-generation plants in various parts of the world including India.

Silence & Stack for GE M S 6001 Turbine supplied to Inso/Nuovo Pignone for Reliance Petroleum, India

Air Intake Silencer to GE Packaged Power System, Houston, USA

BYPASS STACK WITH SILENCER: As a part of the Exhaust system we also manufacture and supply By pass Stack with support Structure, Transition pieces and the Silencers.

Silencers loaded with perforated baffles packed with Ceramic acoustic insulation are designed to ensure that the noise level is maintained within the acceptable limits (85 DBA within 1 mt).

VBV Silencer to GE Packaged Power Systems, Houston, USA for GE LM 6000 Gas Turbine

Silencer Baffles for Various GT Exhaust System Supplied

2590x2590 mm Diverter Flap Valves for GE Exhaust System of LM 6000 Gas Turbine through BSES

Hitherto Fouress has supplied Exhaust systems for GE Gas Turbines up to Frame 9E and Siemens Gas turbines up to V- 94.2A units to GT Combined cycle plants in India and abroad.

Fabric Expansion joints: To take care of the lateral and angular deflection of the ducting due to high temperature gases flowing in the Exhaust system 3 Nos of Fabric Expansion joints (At the Diverter Inlet, Diverter outlet towards the Stack and at the outlet of the Guillotine gate) are provided in the exhaust System as a standard practice.

How Tight is Gas-Tight?

For safe on-load maintenance only 100% gas-tight along the duct is safe enough!

Is 99% good enough?

Remember your school report?

9/10 - V. good

99/100 - Excellent and justly so.

But duct isolation

- that's different!

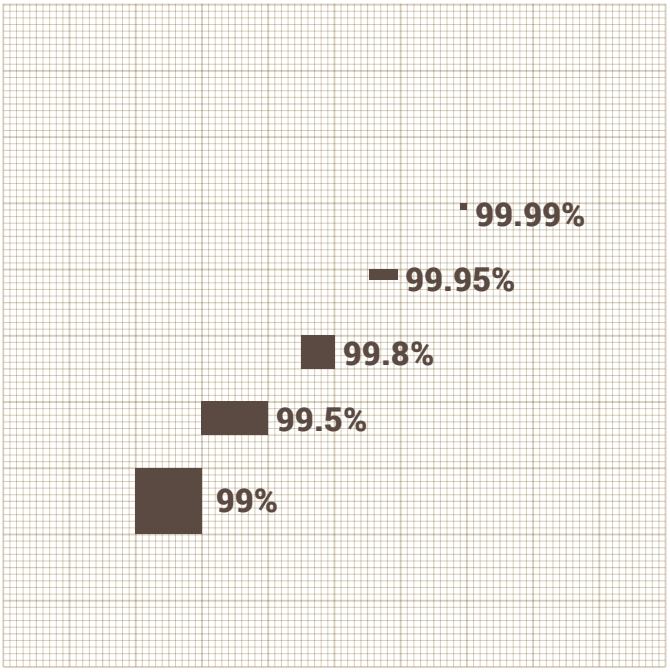
99% is equivalent to a hole one food square in a door ten feet y ten feet

Some draught!!!

Even 99.95% leaves a hole bigger than seven inches square.

For over 40 years Fouress has specialised in duct isolation, and, depending on the required duty, can offer long-term guaranteed tightness of 99.8% to 100%.

We are however reluctant to offer over 100%!!!!



Uses of Fouress Gas Tight Isolators Include:

- Power Plants
- Desulphurisation plant
- Cement Plants
- Refinery & Petrochemicals
- Gas Turbine
- Nuclear
- Paper
- Fertilizer & Chemicals
- Steel

FOURESS
ENGINEERING (INDIA) LIMITED

For commercial enquiries, contact:
Fouress Engineering (India) Ltd.
Plot 2, Phase II, Peenya Industrial Area
BENGALURU - 560 058, Karnataka
Tel: +91 80 2839 5734 2839 5494
Fax: +91 80 2839 5176
E-mail: marketing@fouressindia.com

Chairman's Office & Head Quarters
Mahalaxmi Chambers, 22, Bhulabhai Desai Road,
MUMBAI - 400 026
Tel: +91 22 2353 4400-05
Fax: +91 22 2351 7544
E-mail: hq@fouressindia.com
Website: www.fouressindia.com

Other Plants
Fouress Engineering (India) Ltd.
Plot No.A-324, Road No:21, Wagle Indl. Estate
THANE – 400 604 Maharashtra
Tel: +91 22 2582 3806 / 3602
Fax: +91 22 2582 3603
E-mail: byp@fouressindia.com

Fouress Engineering (India) Ltd.
C-2, MIDC Industrial Area, Paithan - 431 148
AURANGABAD, Maharashtra
Tel: +91 2431 232 074, 232190
Fax: +91 2431 232 058
E-mail: ssk@fouressindia.com

Branches & Representatives

Mumbai	feilmumbai@fouressindia.com
Baroda	feilbaroda@fouressindia.com
Delhi	feildelhi@fouressindia.com
Hyderabad	feilhyd@fouressindia.com
Pune	feilpune@fouressindia.com
Vizag	feilvizag@fouressindia.com
Chennai	feilchennai@fouressindia.com
Nagpur	feilnagpur@fouressindia.com
Kolkata	feilkolkata@fouressindia.com
Bhubaneshwar	feilbbnrs@fouressindia.com
Hospet	feilhospet@fouressindia.com