



Engineering Energy...

***GEA BGR ENERGY SYSTEMS
INDIA LIMITED- A BGR GROUP
COMPANY***

***443, ANNA SALAI, TEYNAMPET,
CHENNAI, TAMILNADU, INDIA***

www.bgrcorp.com

EXCELLENCE IN CONDENSER CARE FOR OVER 25 YEARS

Offering:

Condenser Tube Cleaning System (CTCS)

Debris Filters (DF)

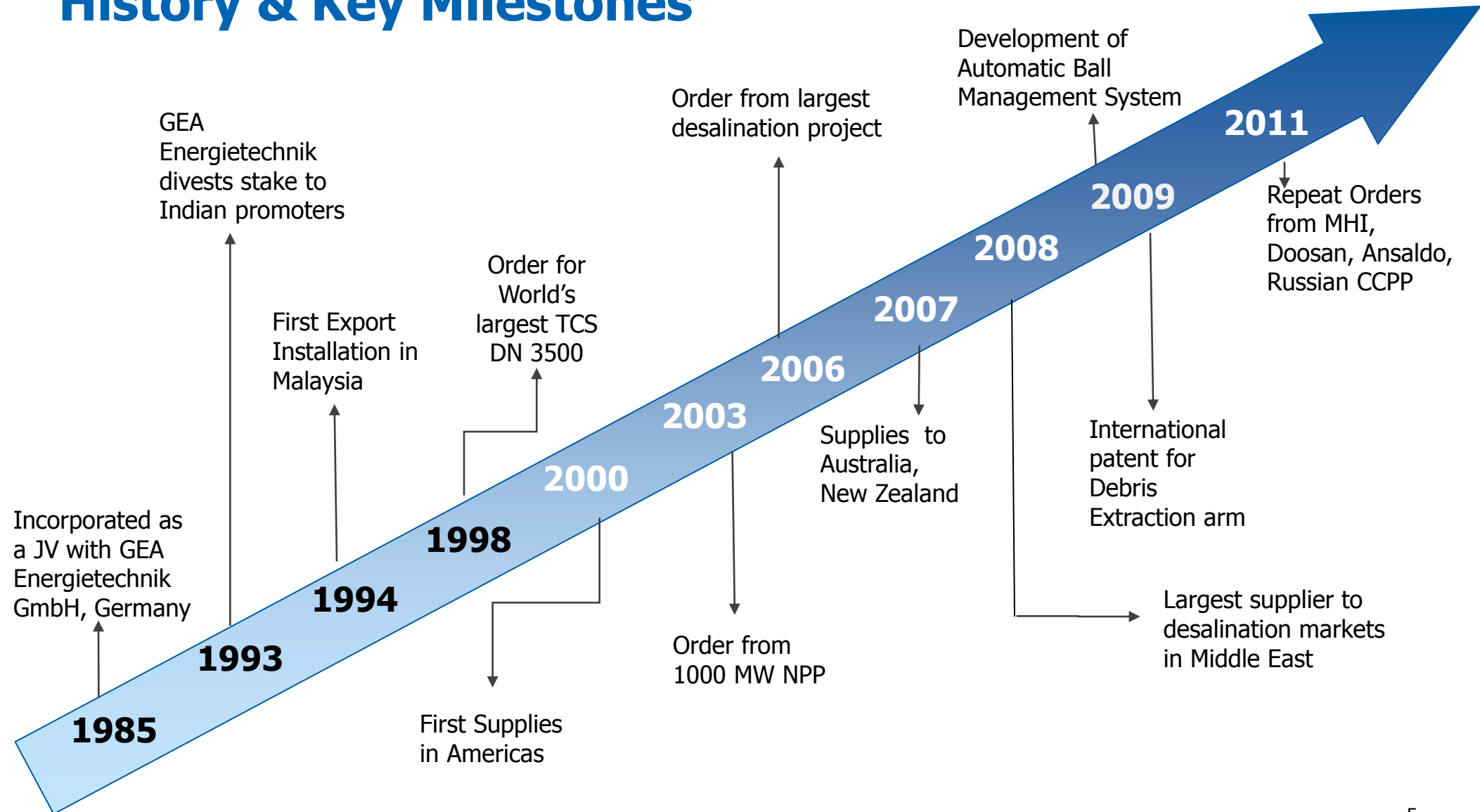
Self Cleaning Strainers (SCS)

Sponge Rubber Cleaning Balls

Markets Addressed:



History & Key Milestones



CURRENT COMPANY SNAPSHOT

- Major Market Share in India and Exports to 42 countries across the globe
- Supplied more than 2000 units (Tube Cleaning system and Debris filter)
- Design work for CTCS and Filter systems handled independently
- ISO 9001: 2008 certified
- Manufactured a Tube Cleaning System of maximum size DN 3500
- International Patent for Debris Extraction Arm of Filters
- R & D facilities that includes a unique performance Test Loop
- Fully owned Subsidiary in Germany for manufacturing Cleaning Balls

WHY the COLTCS is important:

- Corrosion and Fouling in Condenser tubes due to

Suspended Solids	Scaling
Bio fouling	Manganese Deposits
High TDS	

- Increase in velocity due to blockage which cause erosion of tubes

- Tube has to cleaned to maintain the flow, optimize the heat transfer area, life etc

- Methods of tube cleaning are as follows:

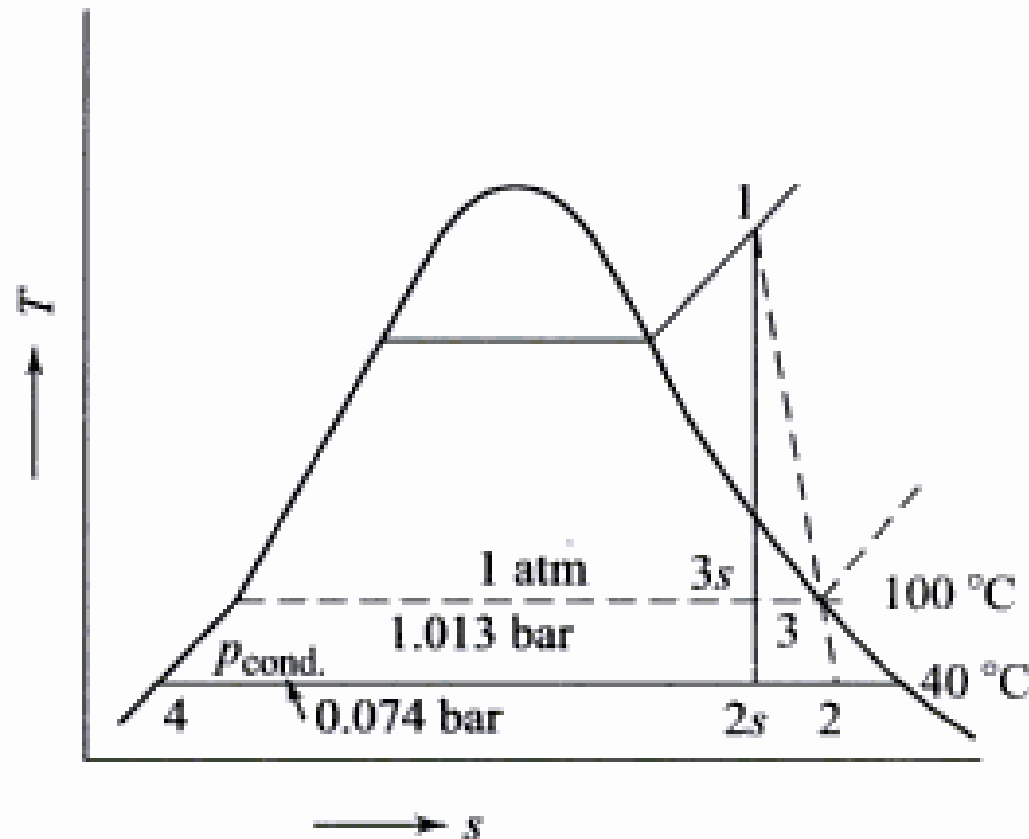
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Types	Disadvantage
Acid cleaning	Corrosion/erosion of tubes
Manual Mechanical cleaning	Protective oxide films are removed causing pitting in the future
Brush cleaning system	High investment and Shut down losses

Condenser and Power Efficiency relation

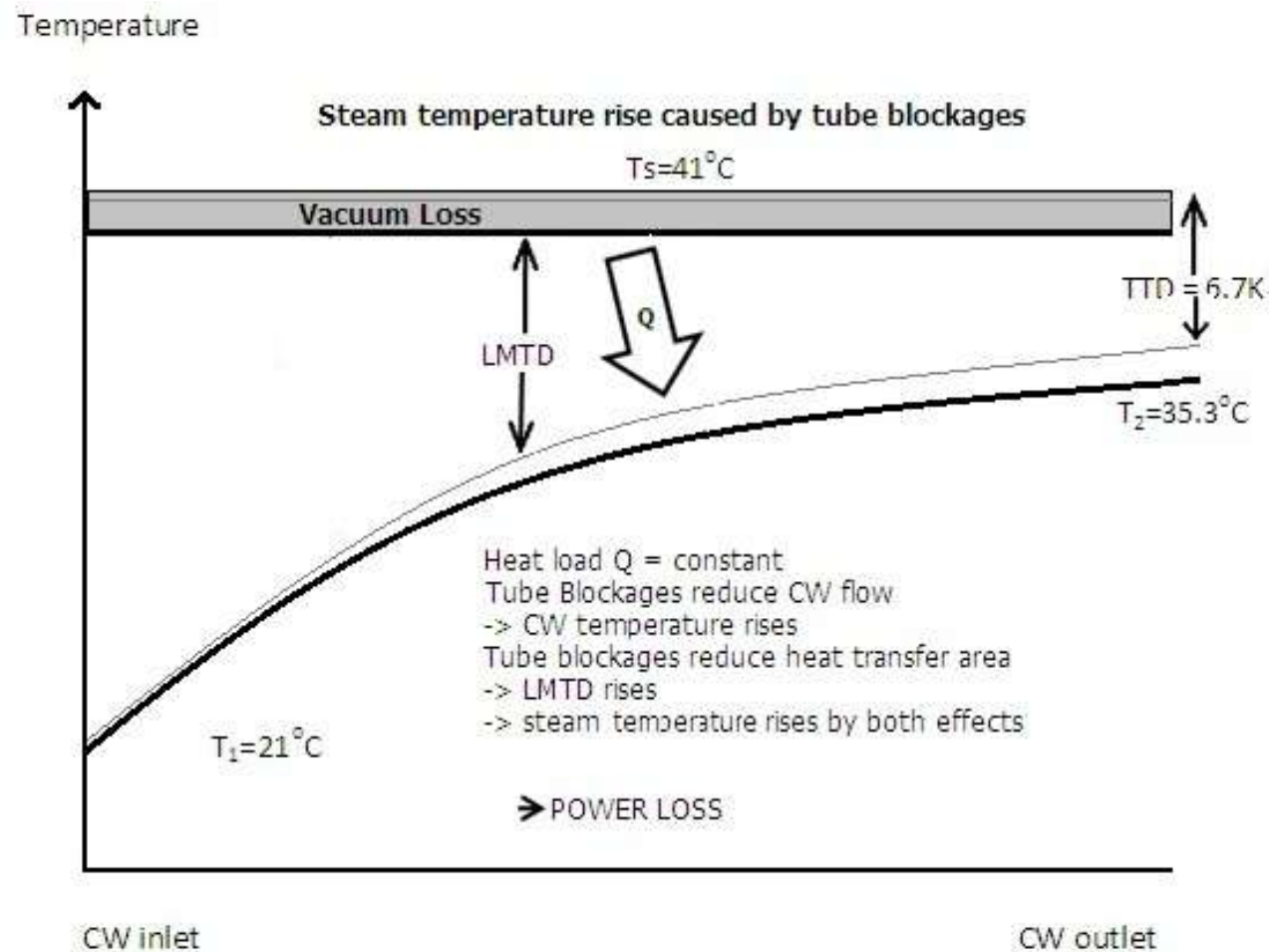
1. Condenser plays a very important role in power generation
 2. Efficient performance of condenser minimizes turbine back pressure, this helps in improved power generation
 3. Every 1% loss in condenser efficiency affects 0.01% of total power generation
 4. Efficiency of condenser largely depend on cleanliness of condenser tubes
- AND THUS THE TUBES HAS TO CLEAN

How COLTCS increase the efficiency of Power Generation

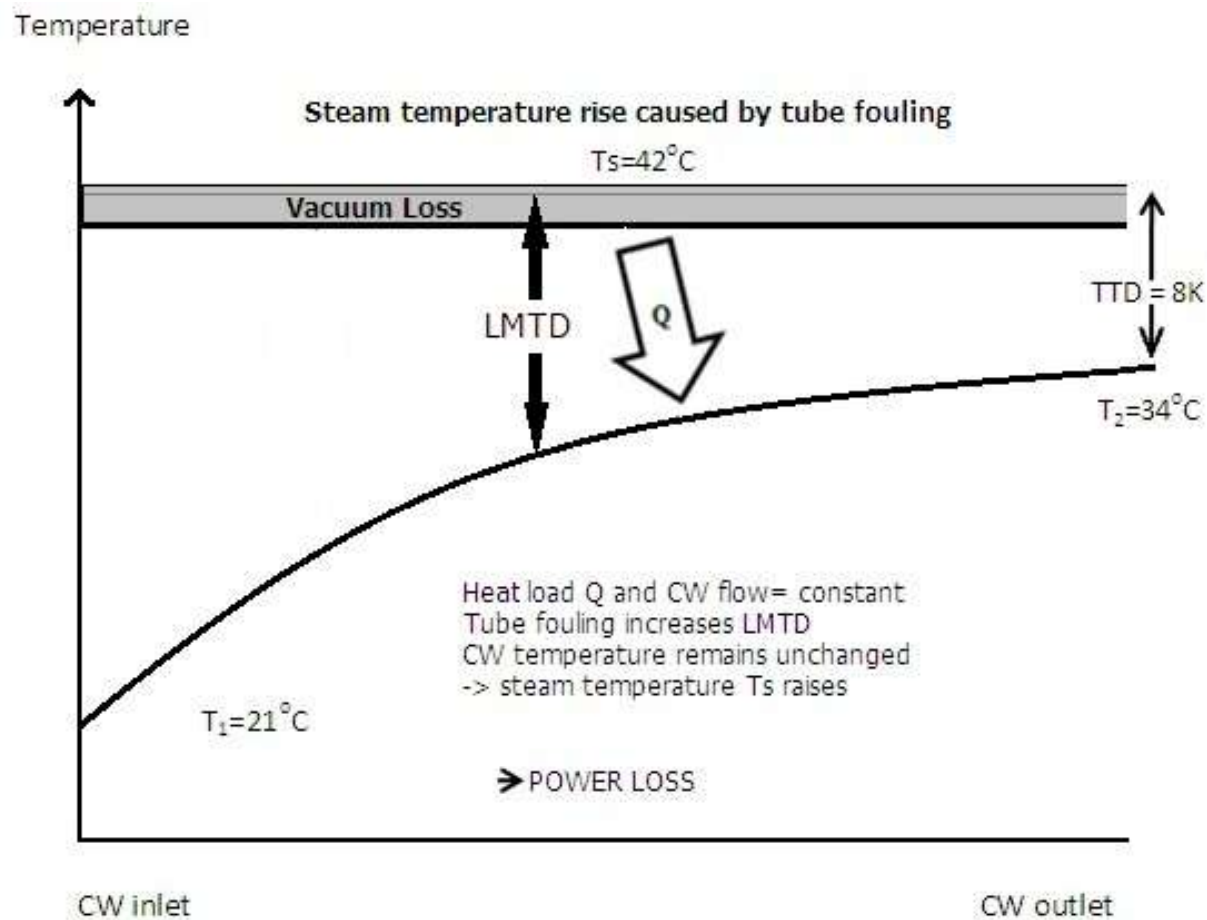


The use of condenser increases the specific work output of turbine from $(h_1 - h_3)$ to $(h_1 - h_2)$

Effect of Tube Blockages



Effect of Tube Fouling



So that's why to chose COLTCS or Condensor On Load Tube Cleaning System

Working principle: Sending cleaning balls (Sponge rubber balls) to through the condenser tubes (Diameter of the ball slightly $>$ internal dia of tubes) so that the tubes get cleaned online.

Advantages:

1. Maximum heat transfer rate in Condenser/heat exchanger
2. Lower turbine back pressure- which leads to max Power generation
3. Enhanced life of condenser tubes
4. Tube failure and thereby Shutdown and losses due to it is eliminated

BENEFITS

MONETARY

- 1. Efficiency of Turbine
- 2. Fuel Savings
- 3. Eliminate chemical costs for cleaning
- 4. Replacement of tubes savings
- 5. Shut down production loss

OTHER INDIRECT BENEFITS

- 1. Time and Man-hours for periodic checks
- 2. Fully automatic operation with alarms and control settings
- 3. Ensuring the cleanliness of the condenser tubes.

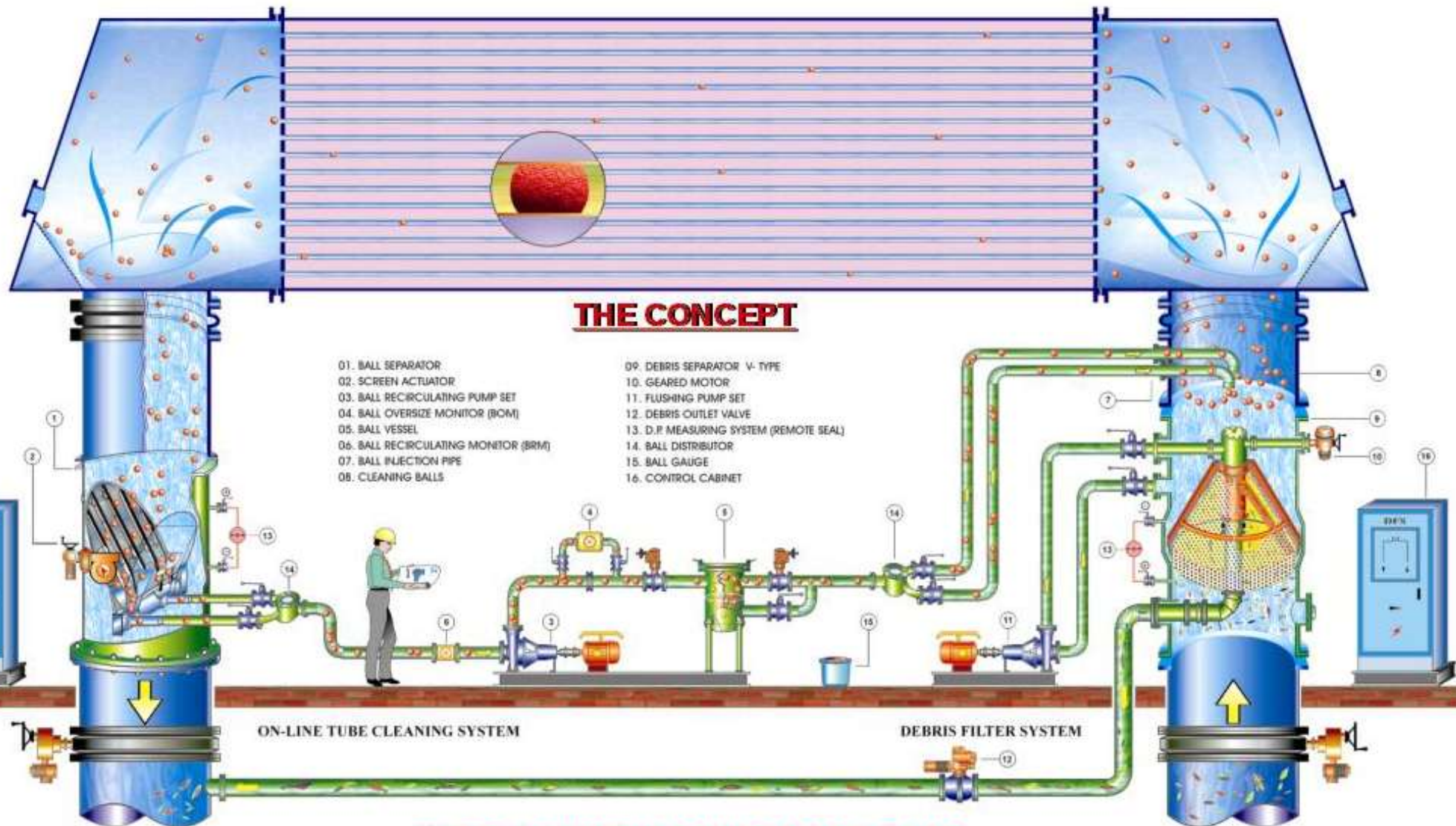
WHY the DFS is important:

- Condenser water sources are sea water, lake, river water and the intake is huge which incorporate lots of debris which are as follows:

Shells	Plastics
Sticks	Waste materials
Stones	Paper

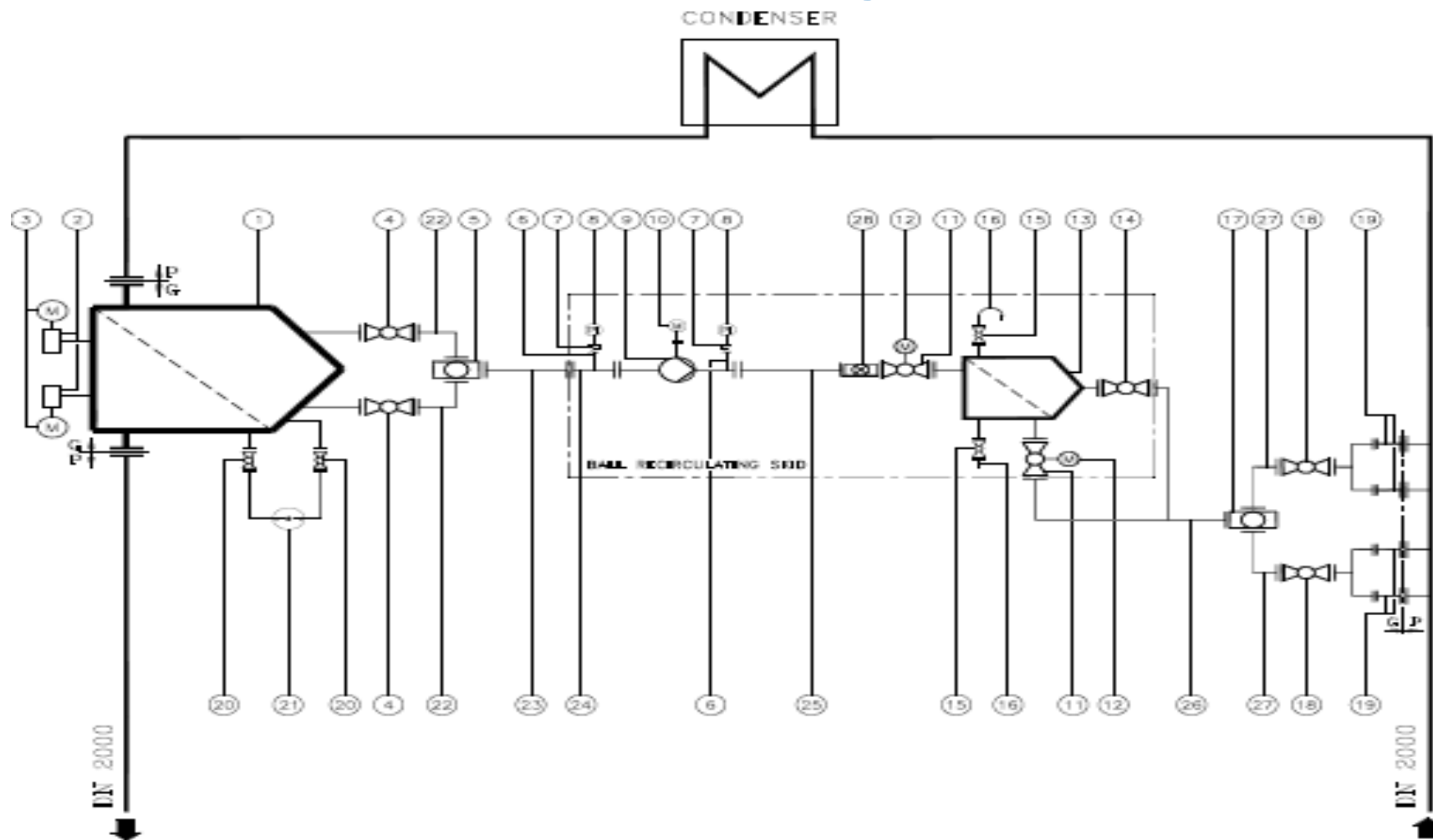


- Debris blocks the tubes leading to CW Velocity increase and thereby causing erosion, pitting on the tubes
- Debris filter system removes the debris before the CW enters the CW tubes



EXCELLENCE IN CONDENSER CARE

A Typical P&I of Tube cleaning system



BALL SEPARATOR

The Ball Separator installed in the C.W. Outlet separates the Cleaning Balls which are then pumped back into the C.W. Inlet

Special Feature:

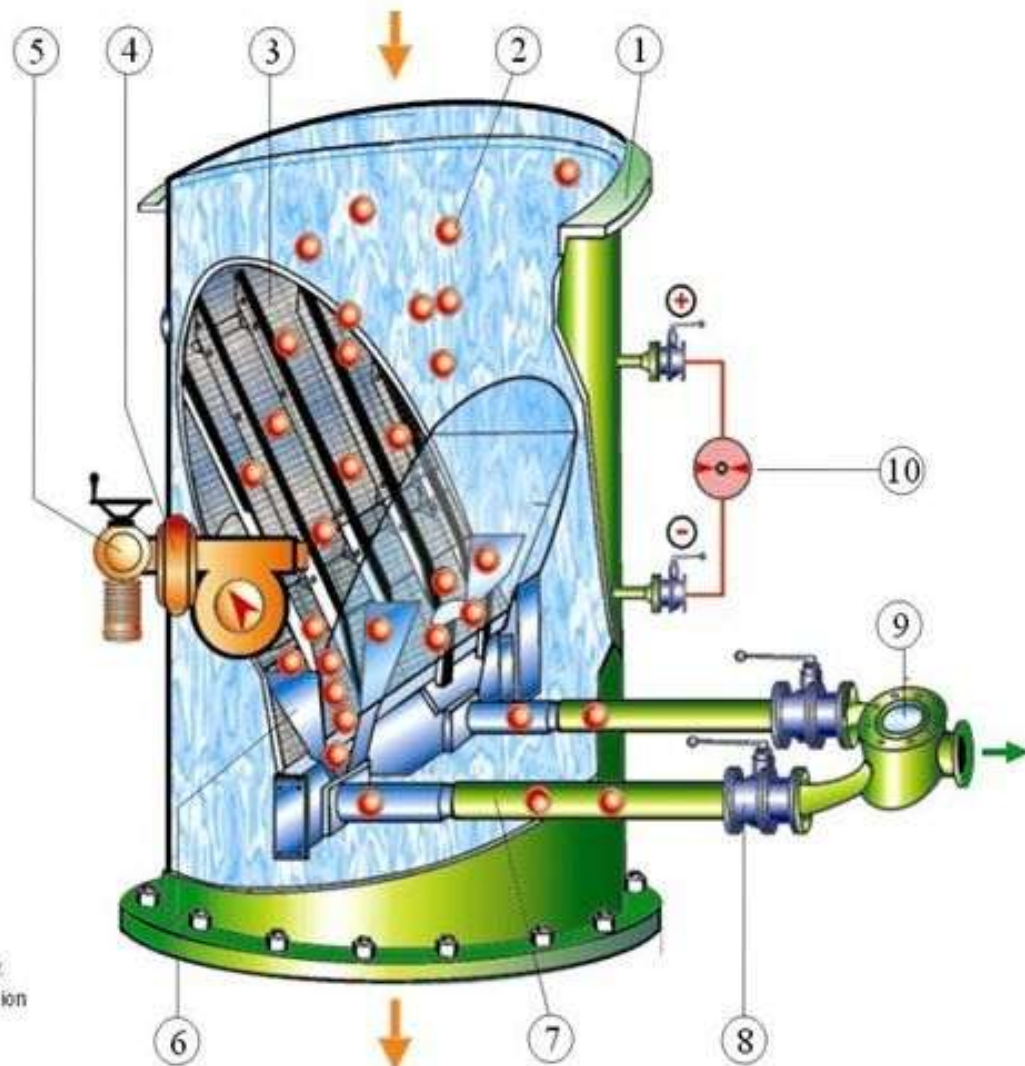
- Individual drives for each screen
- High Ball Collection efficiency

Various sizes & specifications:

Line size	DN 200 (8 in.) to DN 3600 (142 in.) dia.
Flow rates	500 M ³ /Hr. (2201 gpm) To 110000 M ³ /Hr. (484315 gpm)
<u>Materials</u>	
<u>Shell</u>	Carbon Steel, Stainless Steel, Cupro Nickel
<u>Internals</u>	SS 316 Ti, SS 317 LN, Cupro Nickel
Design Standards	ASME / DIN / BS / BIS / JIS



GENERAL ARRANGEMENT OF BALL SEPARATOR



PNO	DESCRIPTION
1	SHELL
2	SPONGE CLEANING BALLS
3	SCREEN
4	WORM GEAR BOX
5	SCREEN ACTUATOR
6	EXTRACTION ARM
7	EXTRACTION PIPE
8	ISOLATION VALVE
9	V - PIECE
10	DP MEASURING SYSTEM

 Main C.W. Flow
 Ball Transportation



Internal View of all Strainer



Differential Pressure Measuring System

- Automatically measures and controls the DP across the screens of the Ball Separator.

- 'Remote seal' diaphragms ensure that measuring lines do not get clogged with debris.

- Houses a transmitter and limit value indicator.

DP Measuring System



BALL RECIRCULATING SKID



The Ball Recirculating Skid is a composite unit with a Ball Recirculating , Ball Vessel and the Inlet and Outlet Valves mounted on it.

Special Features:

- **A special pump to circulate the balls without any damage into the cooling water inlet.**
- **A ball vessel with electrically operated ball valves to facilitate automatic ball charging and collection - hence totally maintenance free.**
- **Ball Monitoring & Automatic Sorting System to reduce operator interface (optional feature).**







CLEANING BALLS

A dedicated facility located in Germany to manufacture the complete range of Cleaning Balls including high temperature balls for Desalination Plants. The plant is equipped to manufacture about 6 million balls per annum.

Types

Sponge Rubber - Hardness selected to suit service conditions

High Temperature Balls - For application upto 140° C (280° F) - Desalination MSF Plants.

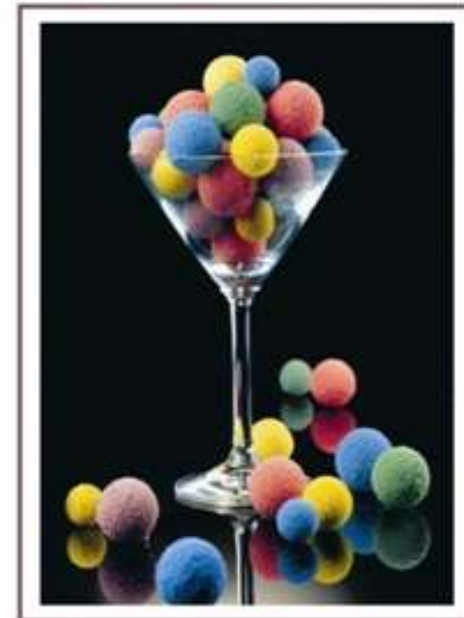
Abrasive Balls - Ring/ Fully coated for removal of hard deposits.

Granulate Coated Balls - For use in Titanium & Stainless Steel Tubes.

Application and Range:

temp. upto 80° C (176° F)

temp. upto 140° C (284° F)



APPLICATION AND RANGE

FOR SEA WATER AND FRESH WATER WITH TEMPERATURE UPTO 80°C(176°F)



- Removal of Salt deposits
- For Copper and brass tubes



Lower sinking velocity



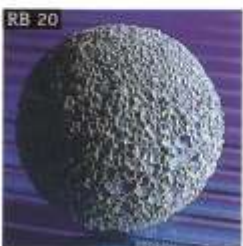
- Removal of Hard Scales CaCO_3
- For Copper and brass tubes



Lower sinking velocity



- Removal of Soft Scales $\text{Mg}(\text{OH})_2$ & FeSO_4
- For welded copper and brass tubes



- For stainless steel, titanium tubes
- RB scouring balls for removal of bio-fouled layers
- RG for removing highly adherent bio-fouled layers



APPLICATION AND RANGE

FOR SEA WATER AND BRINE FLUID WITH TEMPERATURE UPTO 140°C(284°F)
(Desalination Systems)



- Removal of Salt deposits
- For Cupronickel and SS tubes



Lower sinking velocity



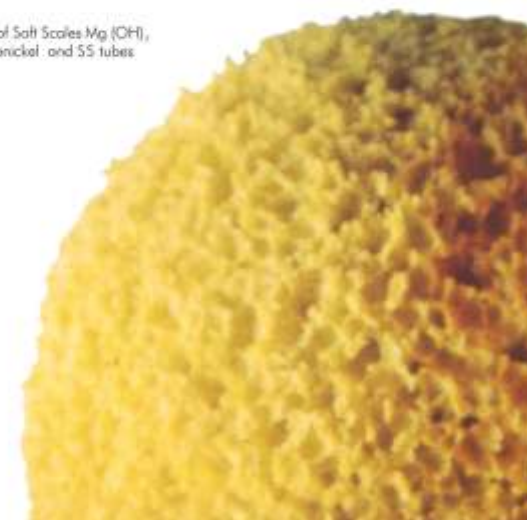
- Removal of hard Scales CaCO_3
- For Cupronickel and SS tubes



Lower sinking velocity



- Removal of Soft Scales $\text{Mg}(\text{OH})_2$
- For Cupronickel and SS tubes



Ball Recirculation Monitor (BRM)

Measures the percentage of cleaning balls with respect to basic charge which are under circulation in the condenser.



Ball Oversize Monitor (BOM)

Statistically detects the number as well as oversize and wear of the cleaning balls in circulation.



CONTROL SYSTEM (SKID MOUNTED)

OPERATION

- ◆ AUTOMATIC
- ◆ MANUAL

INITIATION

- ◆ LOCAL
- ◆ REMOTE. (DCS)

INDICATION

- ◆ PROCESS MIMIC WITH INDICATION
- ◆ AUDIO/ VISUAL ALARMS FOR FAULT DIAGNOSIS

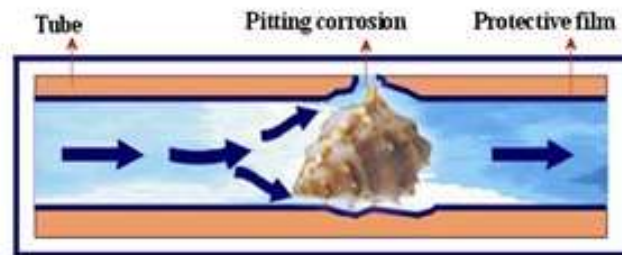
CONTROL SYSTEM

- ◆ CHOICE OF RELAY OR PLC BASED SYSTEMS WITH OR WITHOUT REDUNDANCY



DEBRIS FILTER

Debris such as shells, sticks, stones, and plastics are the common cause of fouling of condenser and heat exchanger tubes. A screening system located as close as possible to condenser water box is now regarded as essential.

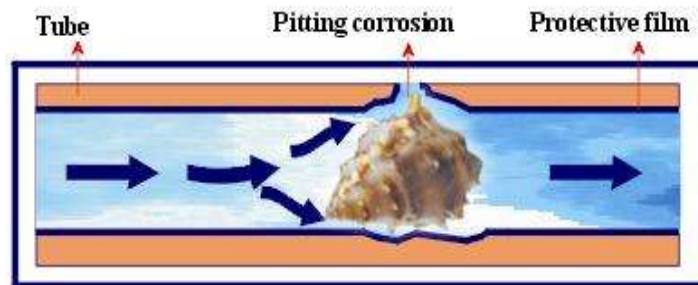


GEA India offers Automatic Debris Separators in a wide range of sizes which fulfil these requirements.

DEBRIS FILTER



Debris such as shells, sticks, stones, and plastics are the common cause of fouling of condenser and heat exchanger tubes. A screening system located as close as possible to condenser water box is now regarded as essential.



"V"-TYPE DEBRIS FILTER

GEA India offers Automatic Debris Separators in a wide range of sizes which fulfil these requirements.

DEBRIS FILTER

The V-Type Debris Separator is designed to be used as a secondary filtering systems in conjunction with travelling band screens.

Design Features

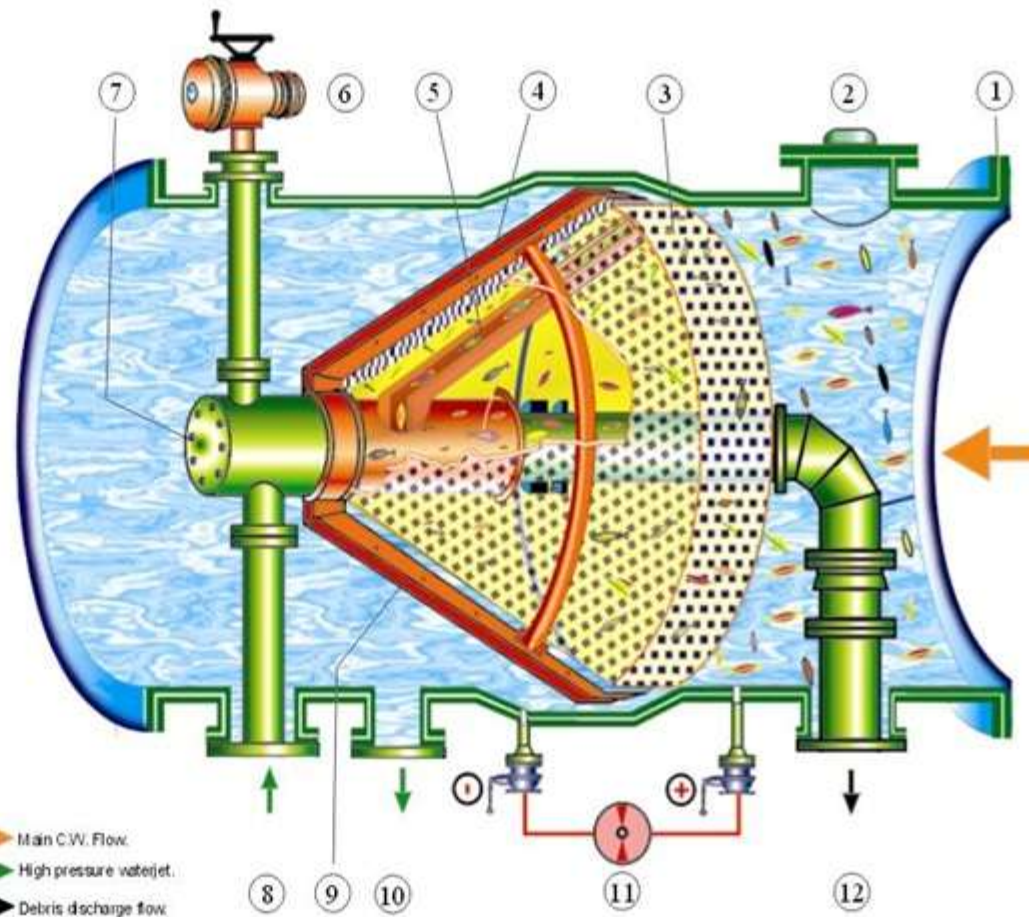
- ✧ Filter basket perforations range from 1 to 10 mm.
- ✧ Normal flushing cycle of 1-3 minutes.
- ✧ Sticky debris, requires an additional facility for effective removal. A high pressure water spray arrangement is provided on the outside of the screen basket for “jet washing”. This is a special feature of GEA design.
- ✧ Low Back wash flow.

Various sizes and specifications

Line size	DN 200 (8 in.) to DN 2800 (110 in.)
Flow rates	400 m ³ /Hr. (1761 gpm) To 65000 m ³ /Hr. (286186 gpm)
<u>Materials</u>	
<u>Shell</u>	Carbon Steel, Stainless Steel, Cupro Nickel
<u>Internals</u>	SS 316 Ti, SS 317 LN, Cupro Nickel
Design Standards	ASME / DIN / BS / BIS / JIS
Installation position	Vertical / Horizontal.

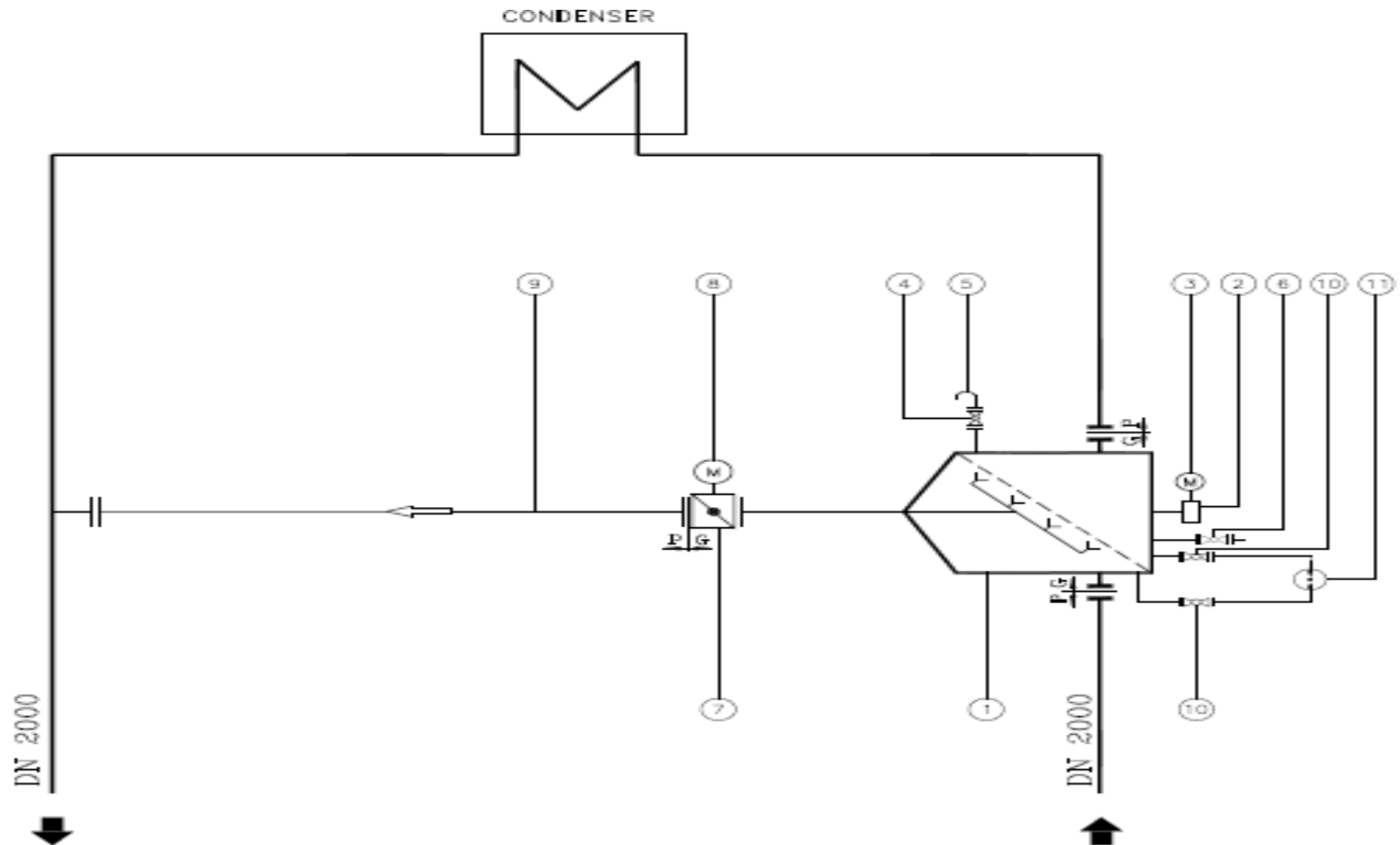


GENERAL ARRANGEMENT OF DEBRIS FILTER



PNO	DESCRIPTION
1	SHELL
2	MAN HOLE
3	SCREEN BASKET
4	INJECTION ARM
5	DEBRIS EXTRACTION
6	GEARED MOTOR
7	GEAR BOX
8	FLUSHING WATER INLET
9	FLOW EQUALIZER
10	FLUSHING WATER OUTLET
11	DP MEASURING SYSTEM
12	DEBRIS DISCHARGE

A Typical P&I diagram of Debris Filter System



Manufacturing Plant



Located about 50 kms (31 miles) from Chennai (India).

Production capacity of 250 systems per year.

Wholly owned subsidiary - M/s. Schmitz GmbH, Germany for manufacturing the complete range of sponge cleaning balls.

Approved by the following Quality Surveillance agencies.

Germanischer Lloyds, Hamburg.

Lloyds Register of Industrial Services



PRODUCTION CENTRE-ISO 9001

Prototype Testing Lab



Prototype Testing Lab



Certifications : ISO 9001



[illegible]

Expertise in different metallurgy

- Body
 - Carbon Steel (A36, A516)
 - Carbon Steel Rubber lined
 - Duplex Stainless Steel
 - (S 31803/32205)
 - Cu-Ni 90:10

- Internals
 - SS 316 / SS 316L / SS 317L /
 - SS 317LNM
 - Duplex Stainless Steel
 - (S 31803/32205)
 - Cu-Ni 90:10

- Design
 - ASME Sec VIII Div I

- WBS/PQR– ASME Sec IX

Experience in Condenser Care

	CTCS	DF	Total
India	675	412	1087
International	429	323	752
Total	1104	735	1839

International Supplies – Region Wise

Quantity in Nos.

	TCS	DF
Middle East	113	47
South East Asia	74	102
Far East	35	23
North Africa	55	50
South America	14	
Russia & CIS	18	24
America	6	
West Europe	11	2
South Asia (Excl India)	5	2

International Supplies – Various sizes

Quantity in Nos.

SIZE	TCS	DF
< DN 1000	76	73
DN 1000 – DN 1800	195	150
DN 1900 – DN 2400	87	56
> DN 2400	2	14

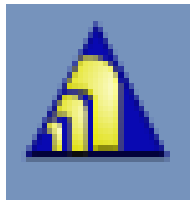
Installed CTCS & DF

Description	Equipment	Total MW (Thermal & Nuclear)
Indian Power Stations	CTCS	91,526
	DF	68,135
International Power Stations	CTCS	56,840
	DF	32,592
International Water Plants (MSF Desalination)	CTCS	754 MiGD
	DF	113 MiGD

Partial Reference List of Customers



Electricity Authority of Cyprus



PRODUCT DEVELOPMENTS

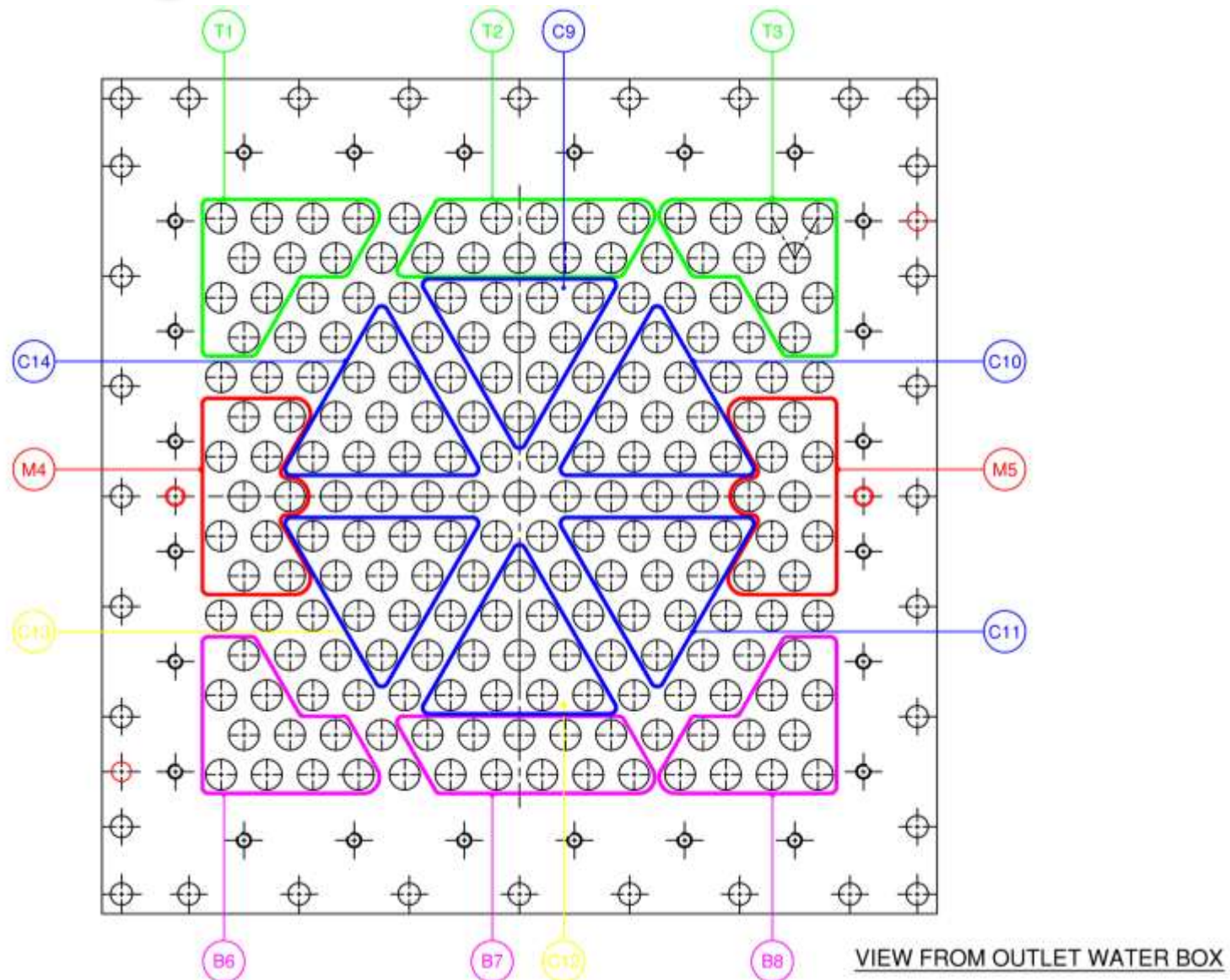
New developments in CTCS

- ❖ Ball distribution Test for Condenser
- ❖ Strengthening of Screen/ supports
- ❖ Ball Monitors for Thermal Power Plants
- ❖ Automatic Ball Sorting system
- ❖ 8 Screen Strainer design for Large Condensers

Test Loop with Condenser



Cage Arrangement on Tube Sheet



Ball Catching Cage on Tube Sheet



Test Result

SUMMARY OF BALL DISTRIBUTION TESTS

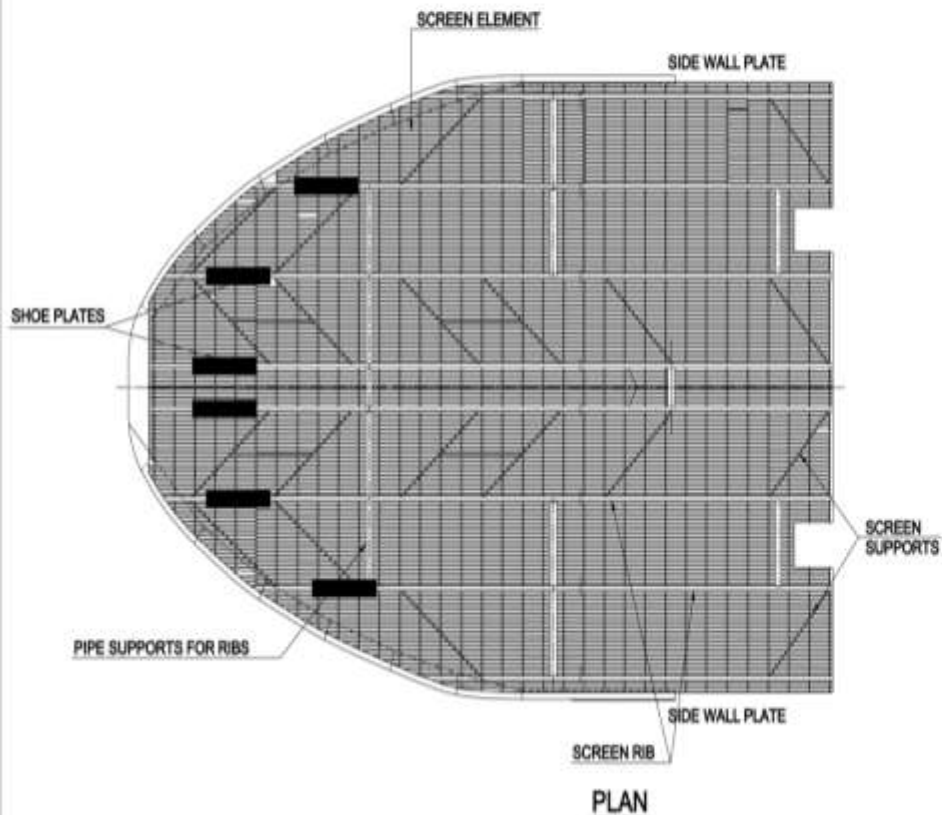
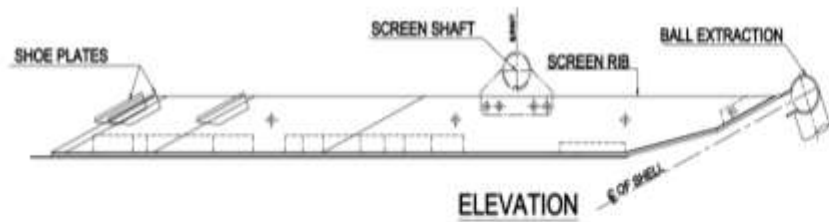
BALL DISTRIBUTION TEST IN MODEL CONDENSER

CONDENSER DATA :

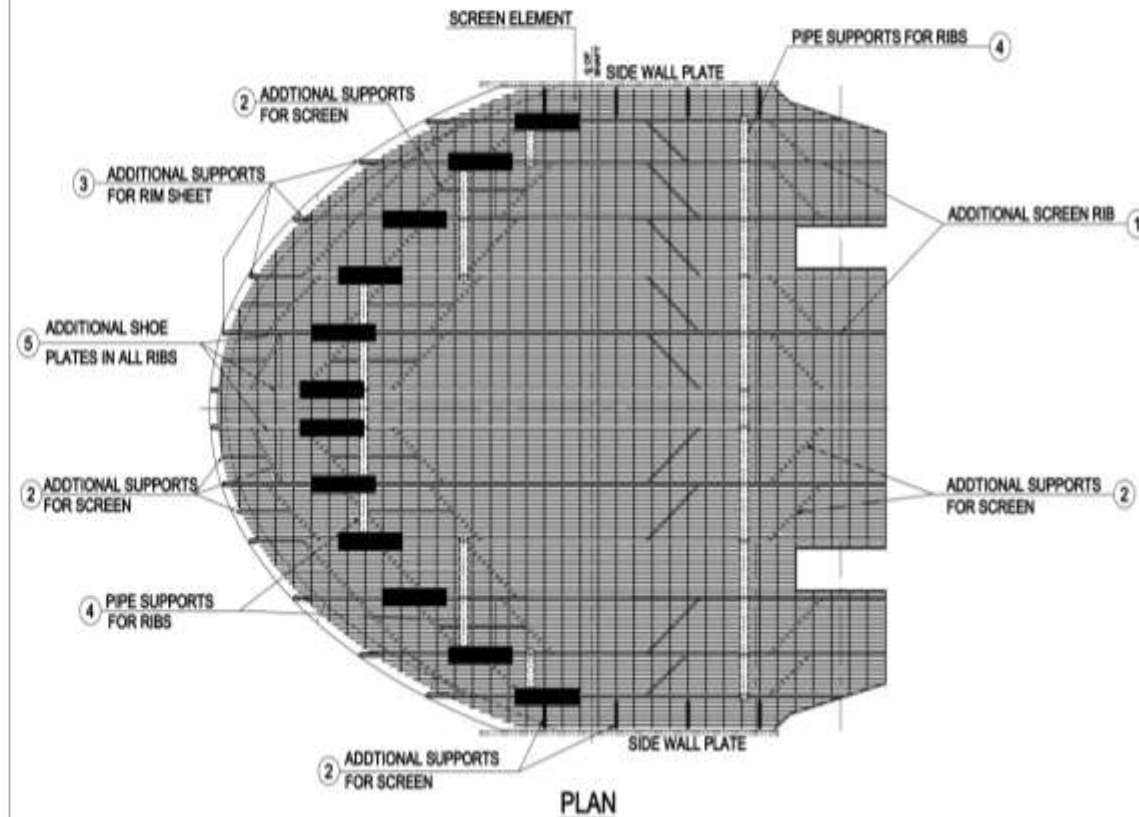
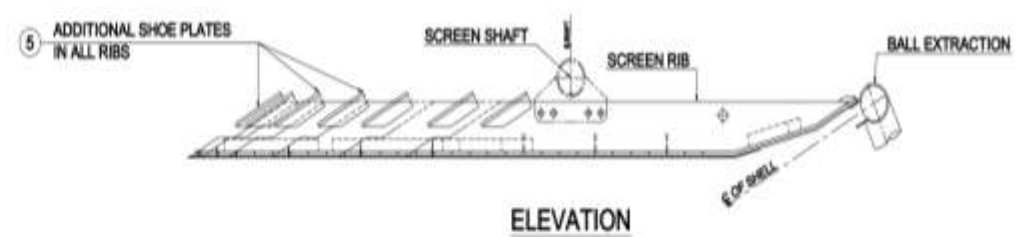
No. of tubes :	203 Nos.	Test Dates:	05.01.2012 - 09.01.2012	Ball Size:	Dia. 23mm
Tube Internal Dia:	22 mm	Condenser DP :	25.6 mbar	Type of Circulation:	Batch
No. of Ball catchers:	14 Nos.	Water Flow:	541 m3/hr.	No. of Balls Injected:	100 Nos.
No. of Tubes/catcher:	10 Nos.	CW Pump Suction/Dis :	0.33 / 1.95 Kg/cm2 (g)		
No. of Balls covered by Ball catcher:	140	Voltage / Frequency :	410 V / 50 Hz.		
No. of Balls not Covered by Ball Catcher:	63				

Ball Type	Test Date	NUMBER OF BALLS COLLECTED IN BALL CATCHER														Total Balls collected in Ball Catcher (A)	Total Balls collected in Ball Vessel (B)	Total balls Collected in Ball Catchers & ball Vessel (A + B)
		T1	T2	T3	M4	M5	B6	B7	B8	C9	C10	C11	C12	C13	C14			
		Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.	Nos.
RB MEDIUM	05.01.2012	6	4	5	5	7	6	4	5	6	5	7	6	4	5	75	25	100
	06.01.2012	5	6	4	4	5	7	6	4	5	6	5	4	6	5	72	28	100
	07.01.2012	5	6	5	4	5	4	5	6	4	6	6	4	5	4	69	31	100
	09.01.2012	5	4	7	6	4	5	6	4	5	6	4	5	5	4	70	30	100

OLD SCREEN DESIGN



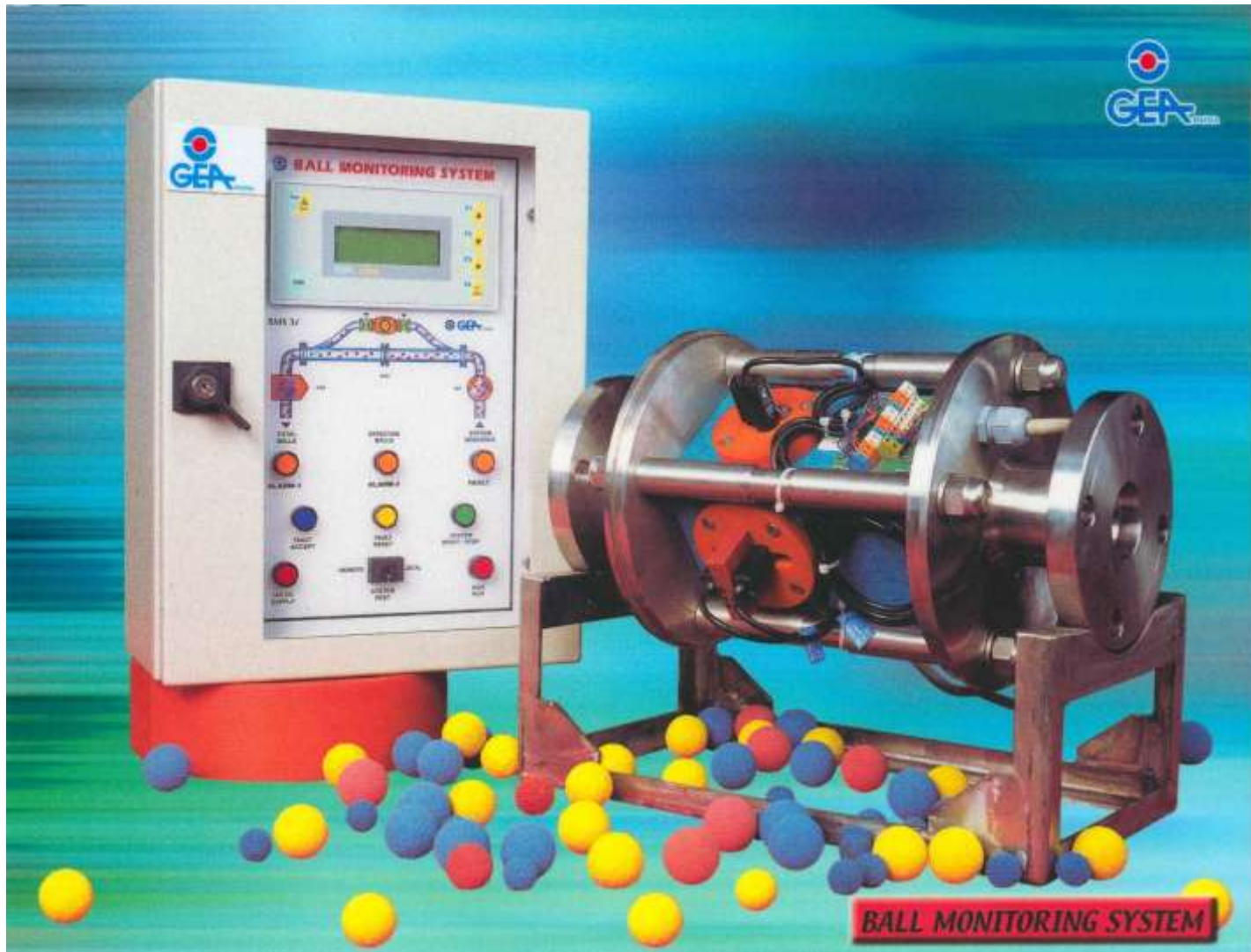
IMPROVED SCREEN DESIGN



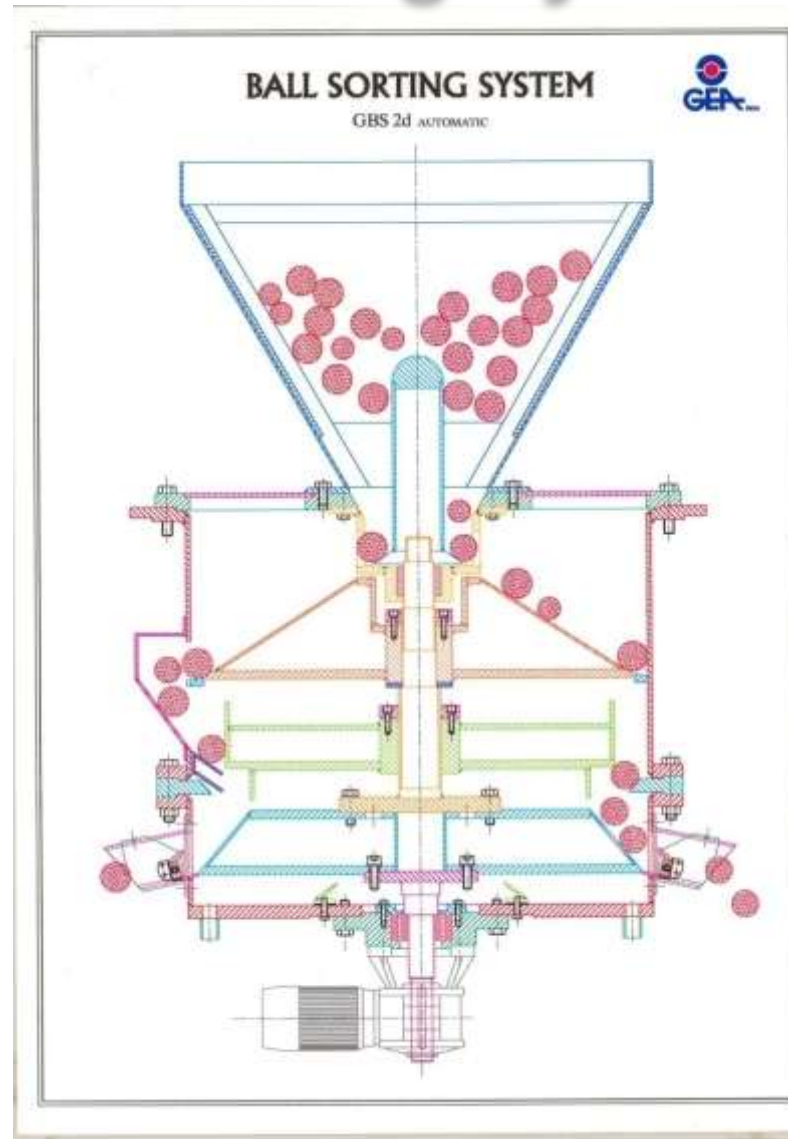
Ball Recirculating Monitor for Thermal Plants



Ball Monitoring System



Automatic Ball Sorting System (Offline)



AUTOMATIC BALL MANAGEMENT SYSTEM

The diagram illustrates the Automatic Ball Management System (ABMS) for a nuclear reactor. It features a central vertical shaft with a hopper at the top for ball storage. A series of rotating drums and conveyors manage the distribution of balls (represented by red and yellow spheres) to different parts of the system. Key components include a 'BALL FEEDING LINE' on the left, a 'BALL RETURN LINE' on the right, and a 'BALL STORAGE LINE' at the bottom. The system is mounted on a base with multiple support legs.

Auto Ball Management System



Unique 8 Screen Design

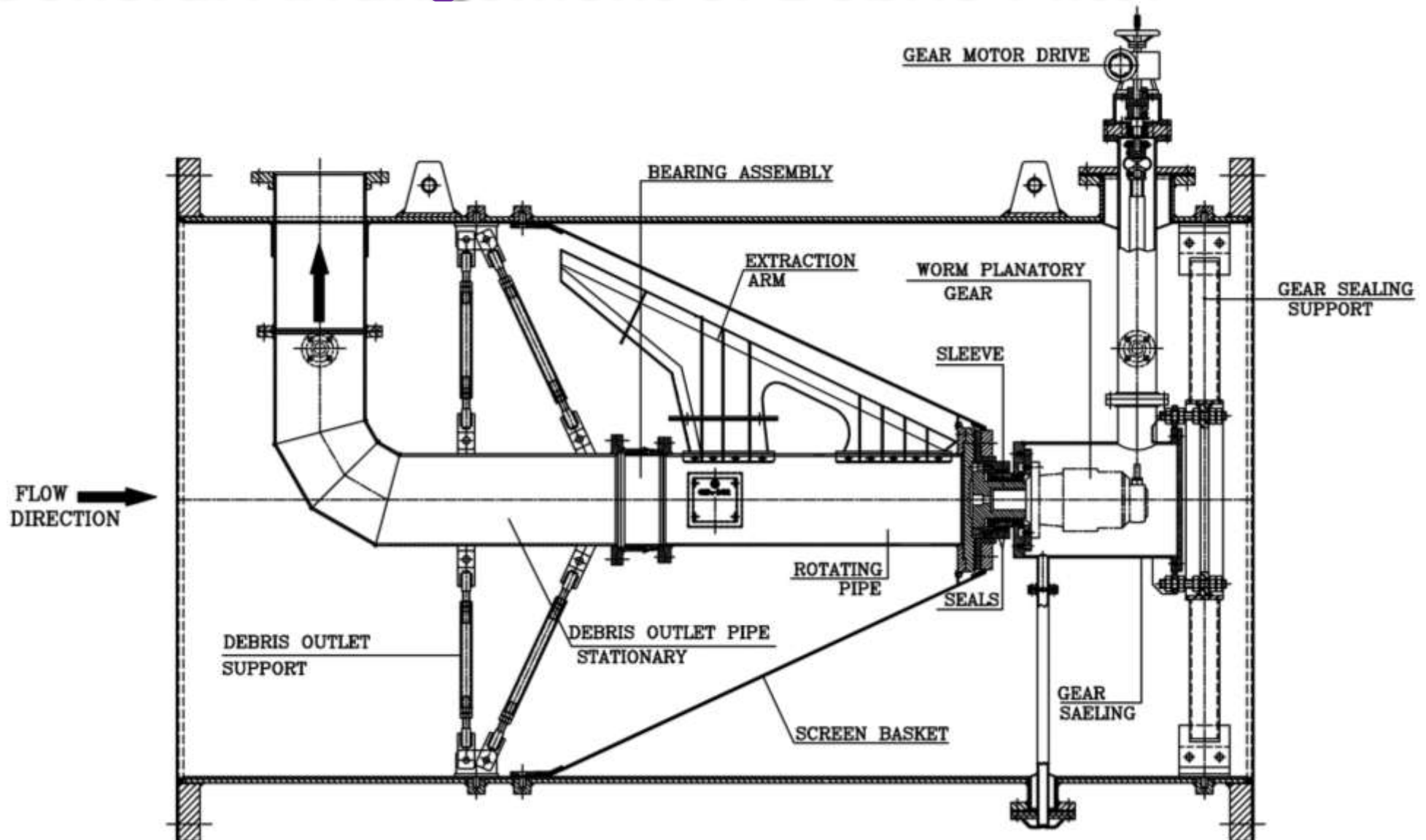


DN 3500 size Ball Separator for 720 MW TPP/ Indonesia

New developments in Debris Filters

- ❖ Improved Screen basket fixing arrangement
- ❖ Effective transmission of rotation
- ❖ New & improved patented Extraction arm
- ❖ Wedge Wire Screens
- ❖ Elbow Filter for Low DP and easy maintenance

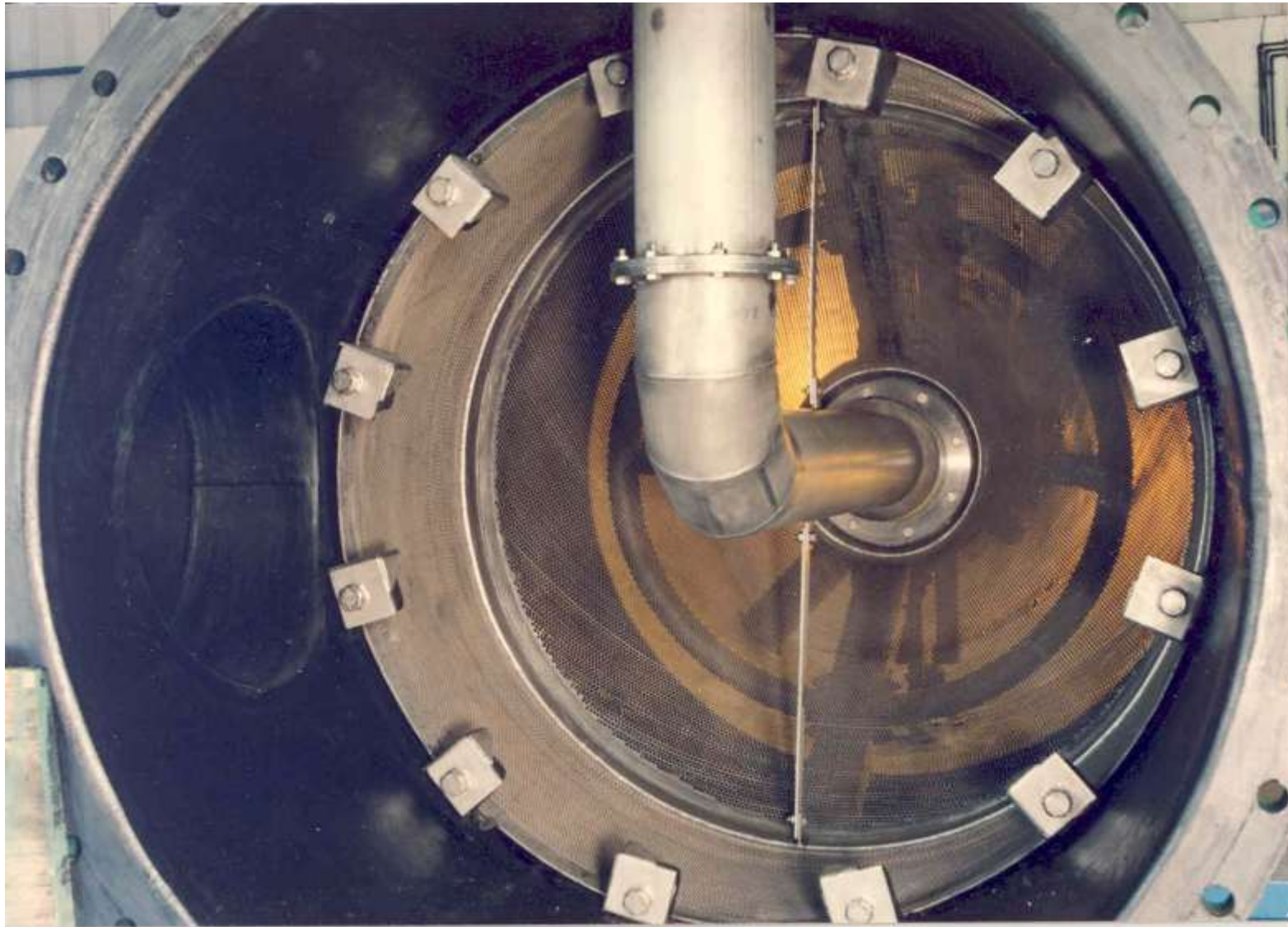
General Arrangement of Debris Filter



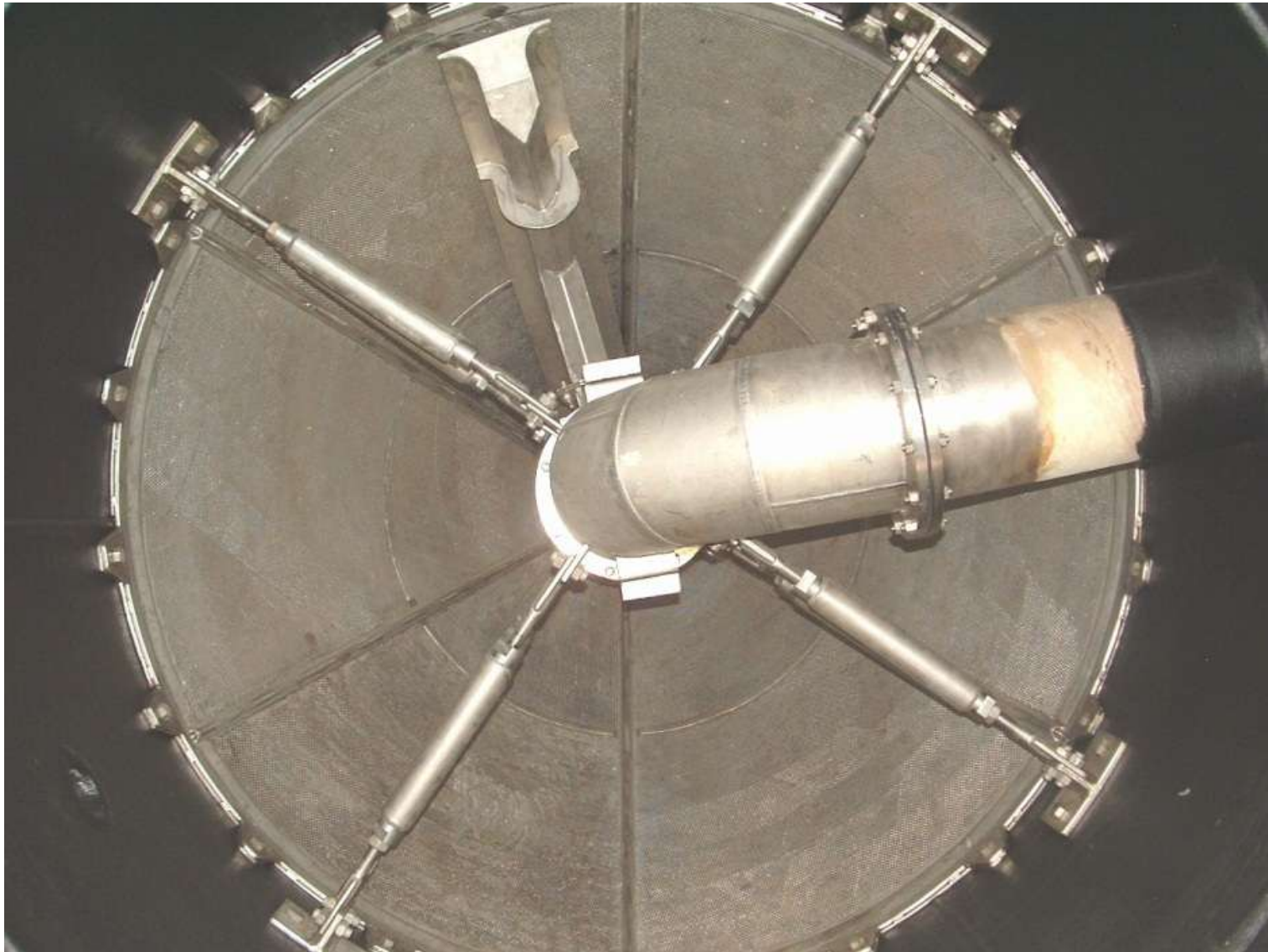
Modified Screen Basket Fixing Arrangement

- ❖ Existing cleat arrangement for fixing basket with shell is of box type.
- ❖ With increased filter size and turbulent flow, these cleats tend to bend and leads to misalignment of basket & rotary assembly.
- ❖ The modified BOSS & CLEAT type is very rigid eliminating the possibility of misalignment of basket and rotary assembly.

Original L – Type Cleat Arrangement



Developed Boss & Cleat Arrangement



Effective Transmission of Motion by Flanged Sleeve

- ❖ Earlier the transmission of rotation from gearbox to injection arm assembly was Through Key and fasteners on the sleeve component.
- ❖ These fasteners got sheared at high torque.
- ❖ To overcome this problem, Flanged sleeve is introduced which is capable of transmitting high torque.

Effective Transmission of Motion by Flanged Sleeve

- ❖ **Key & fasteners eliminated and there by one weak link in transmission was eliminated**
- ❖ **Transmission of motion is done through heavy fasteners at enlarged PCD**
- ❖ **This design was validated with respective Gear box at our R&D**

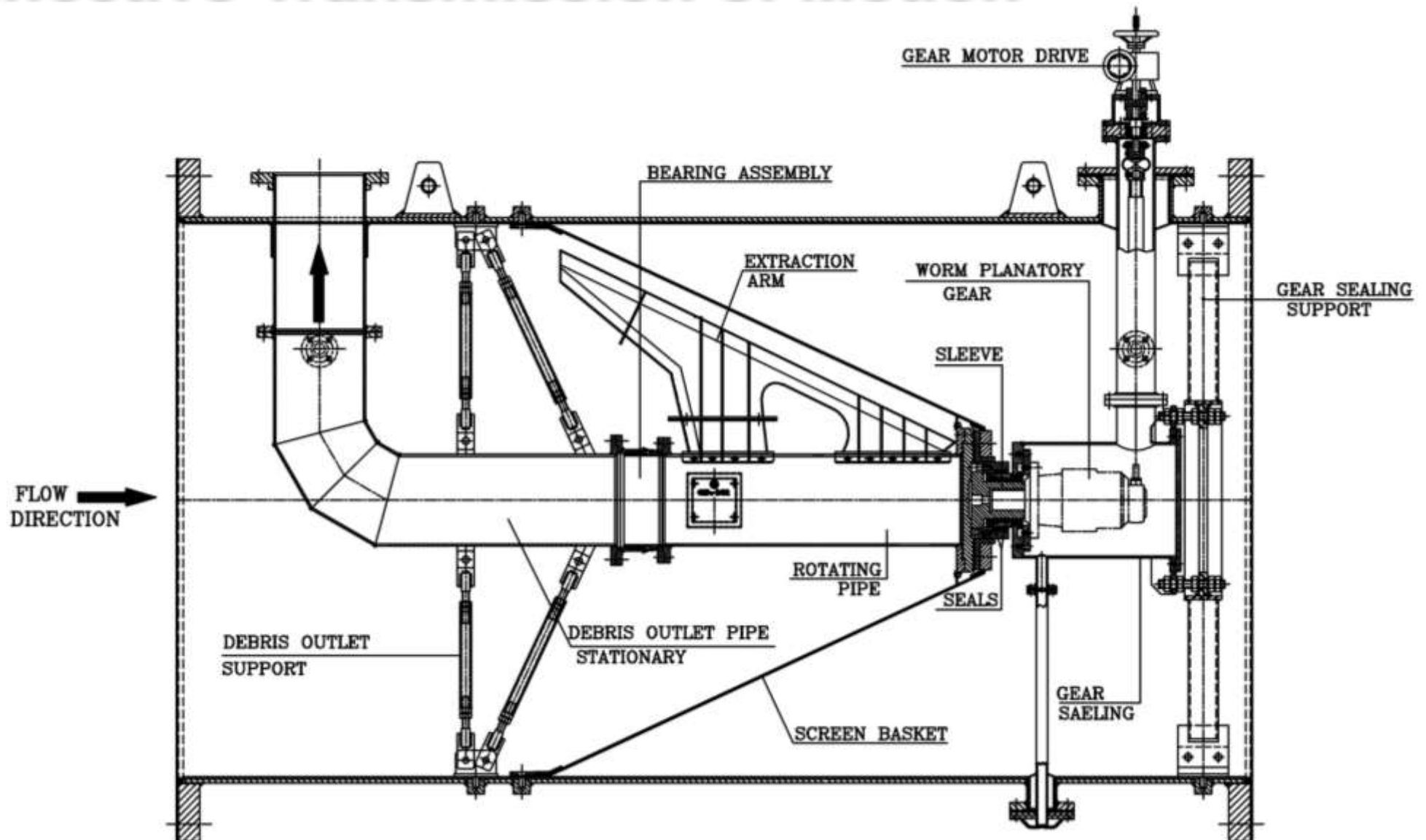
Old Sleeve



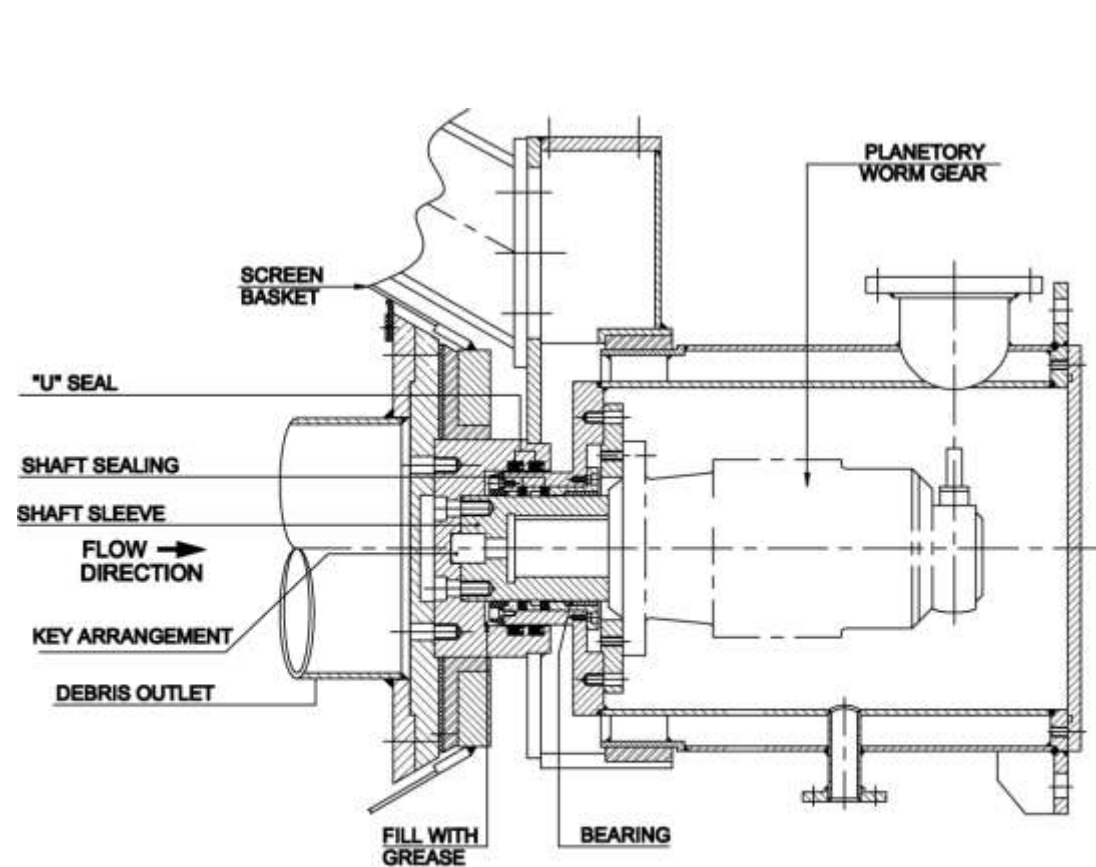
New Flanged Sleeve



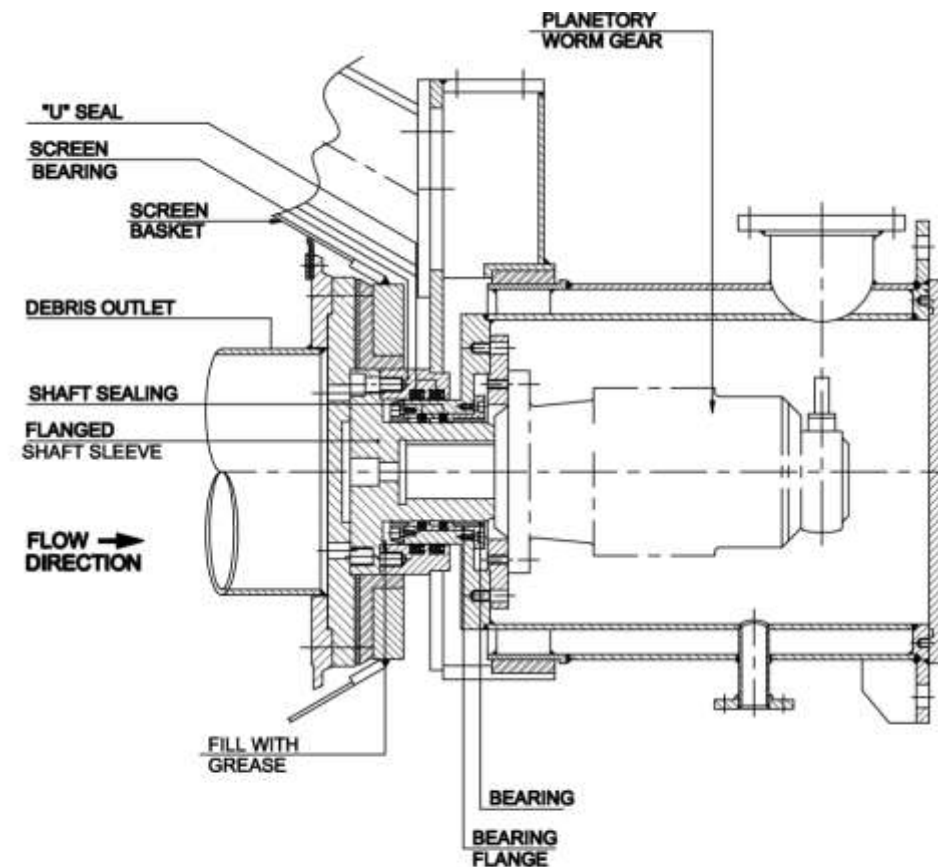
Effective Transmission of Motion



Effective Transmission of Motion (Flanged Sleeve)



SLEEVE WITH KEY ARRANGEMENT

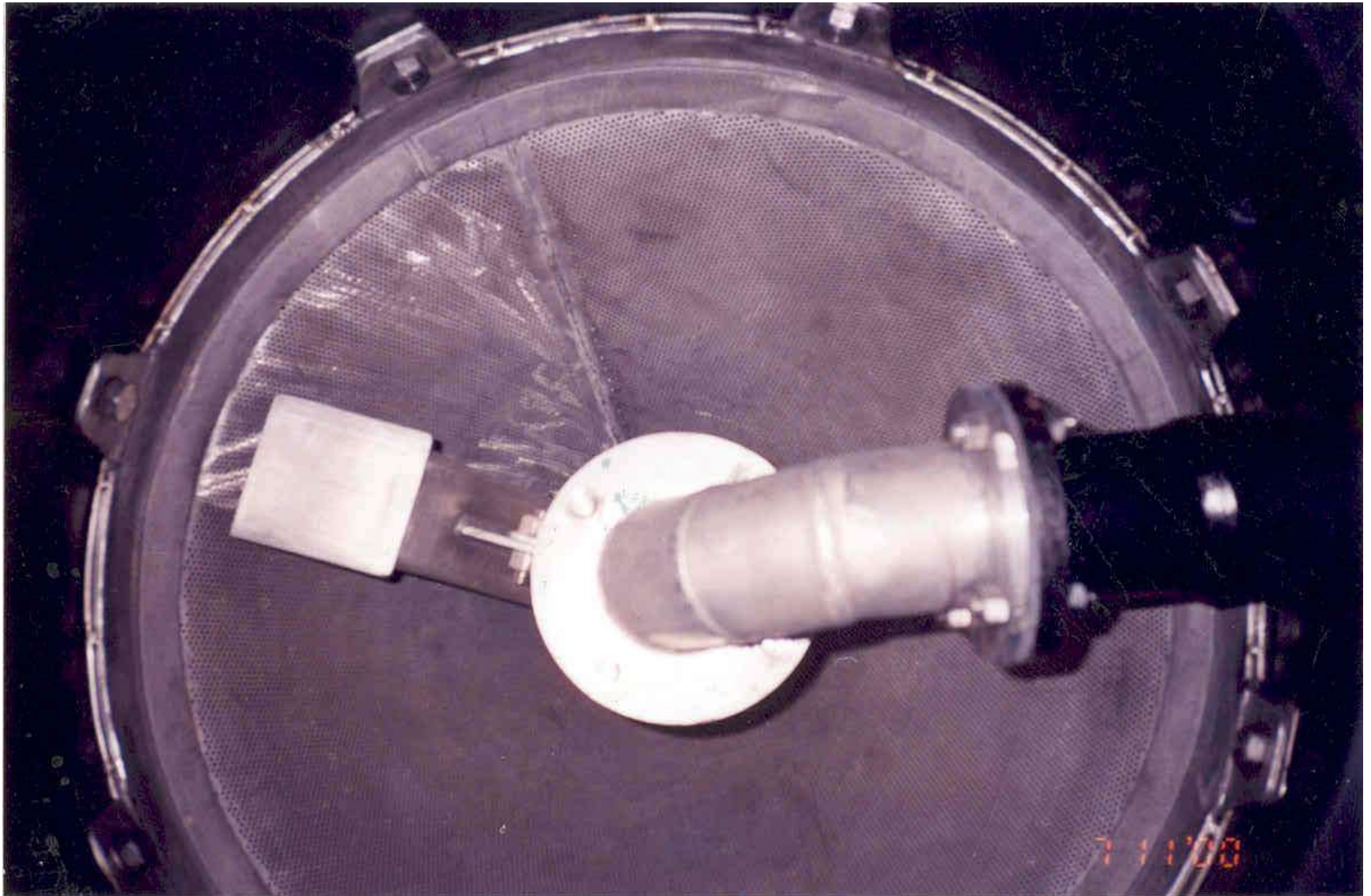


FLANGED SLEEVE (MODIFIED DESIGN) ARRANGEMENT

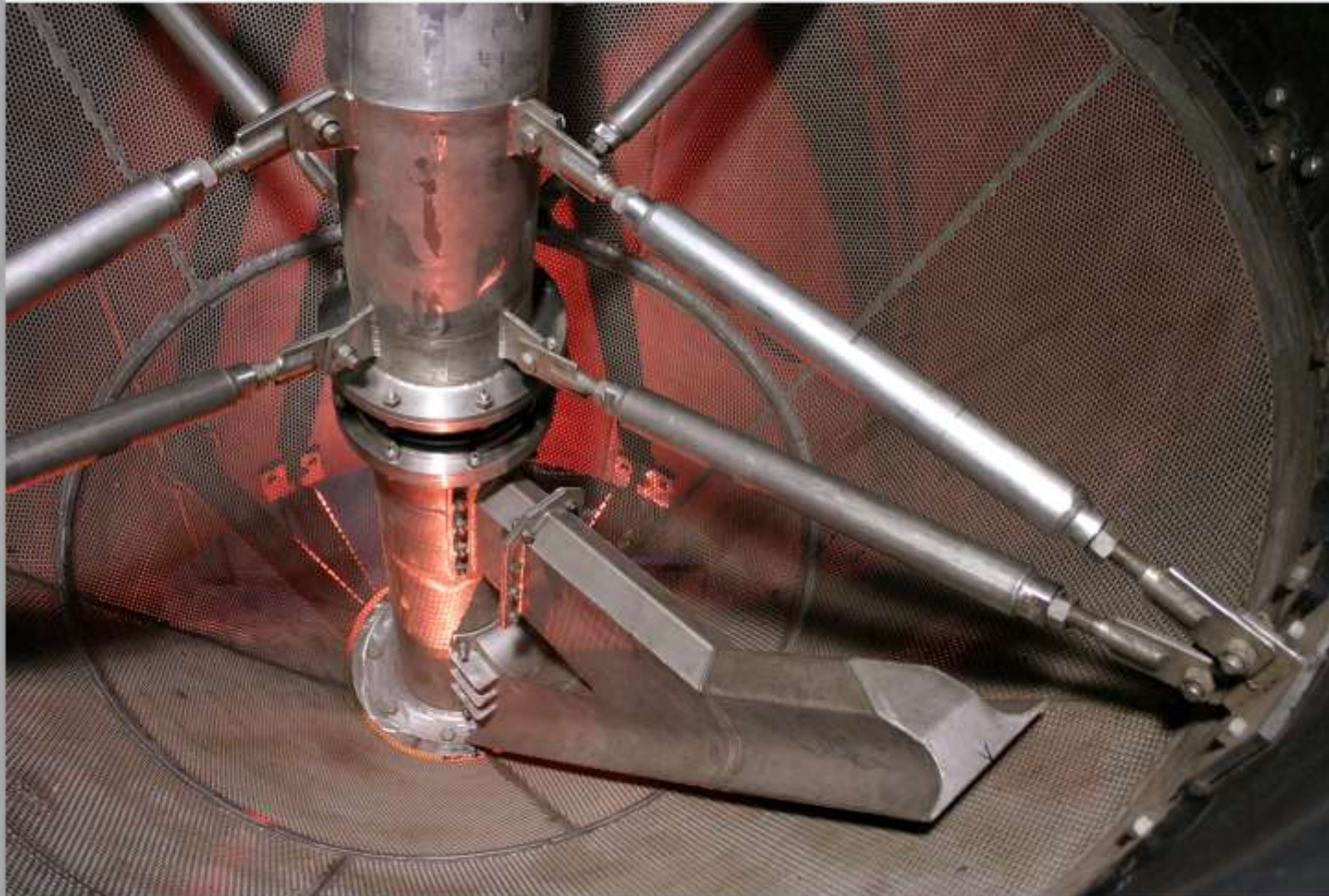
Rigid & Effective of Extraction Arm

- ❖ In house developed high efficient profiled extraction Arm.
- ❖ This design works on differential pressure principle.
- ❖ High and uniform suction effect.
- ❖ This design was patented.
- ❖ With this design of extraction arm, no any back flushing arrangement is required

Old Debris Extraction Arm



Debris Filter with High Performance Extraction Arm



Patent for our Debris Extractor



URKUNDE

Es wird hiermit bescheinigt, dass für die in der Patentschrift beschriebene Erfindung ein europäisches Patent für die in der Patentschrift bezeichneten Vertragsstaaten erteilt worden ist.

Europäisches Patent Nr.

CERTIFICATE

It is hereby certified that a European patent has been granted in respect of the invention described in the patent specification for the Contracting States designated in the specification.

European patent No.

1521625

Patent holder

Proprietor of the patent

GEA BGR Energy System India Ltd.
100, IV Street
Abhiramapuram
Chennai 600 018/IN

CERTIFICAT

Il est certifié qu'un brevet européen a été délivré pour l'invention décrite dans le fascicule de brevet, pour les États contractants désignés dans le fascicule de brevet.

Brevet européen n°

Titulaire du brevet

München, 11.03.09
Pat. & Markenfr.

11.03.09

Alison Brimelow

Präsidentin des Europäischen Patentamts
President of the European Patent Office
Présidente de l'Office européen des brevets



(11) EP 1 521 625 B1

EUROPEAN PATENT SPECIFICATION

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PCT/IN2002/003149

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(87) International publication number:
WO 2004/007051 (22.01.2004 Gazette 2004/04)

(54) **A DEBRIS FILTER WITH A ROTATING DEBRIS EXTRACTOR**
TRÜMMERFÄNGER MIT ROTIERENDEM TRÜMMEREXTRAKTOR
FILTRE A DEBRIS DOTE D'UN EXTRACTEUR DE DEBRIS ROTATIF

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FR GB GR
IE IT LI LU MC NL PT SE SK TR

(74) Representative: Kesselt, John Hinton
Saunders & Dolleymore,
9 Rickmansworth Road
Watford,
Hertfordshire WD18 6JU (GB)

(43) Date of publication of application:
13.04.2005 Bulletin 2005/15

(73) Proprietor: GEA BGR Energy System India Ltd.
Abhiramapuram
Chennai 600 018 (IN)

(56) References cited:
US-A- 4 204 961 US-A- 4 352 739
US-A- 5 106 592

(72) Inventor: BALAKRISHNAN GOVINDASAMY,
Raghupathy
Chennai 600 018,
Tamil Nadu (IN)

Note: Within nine months of the publication of this mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

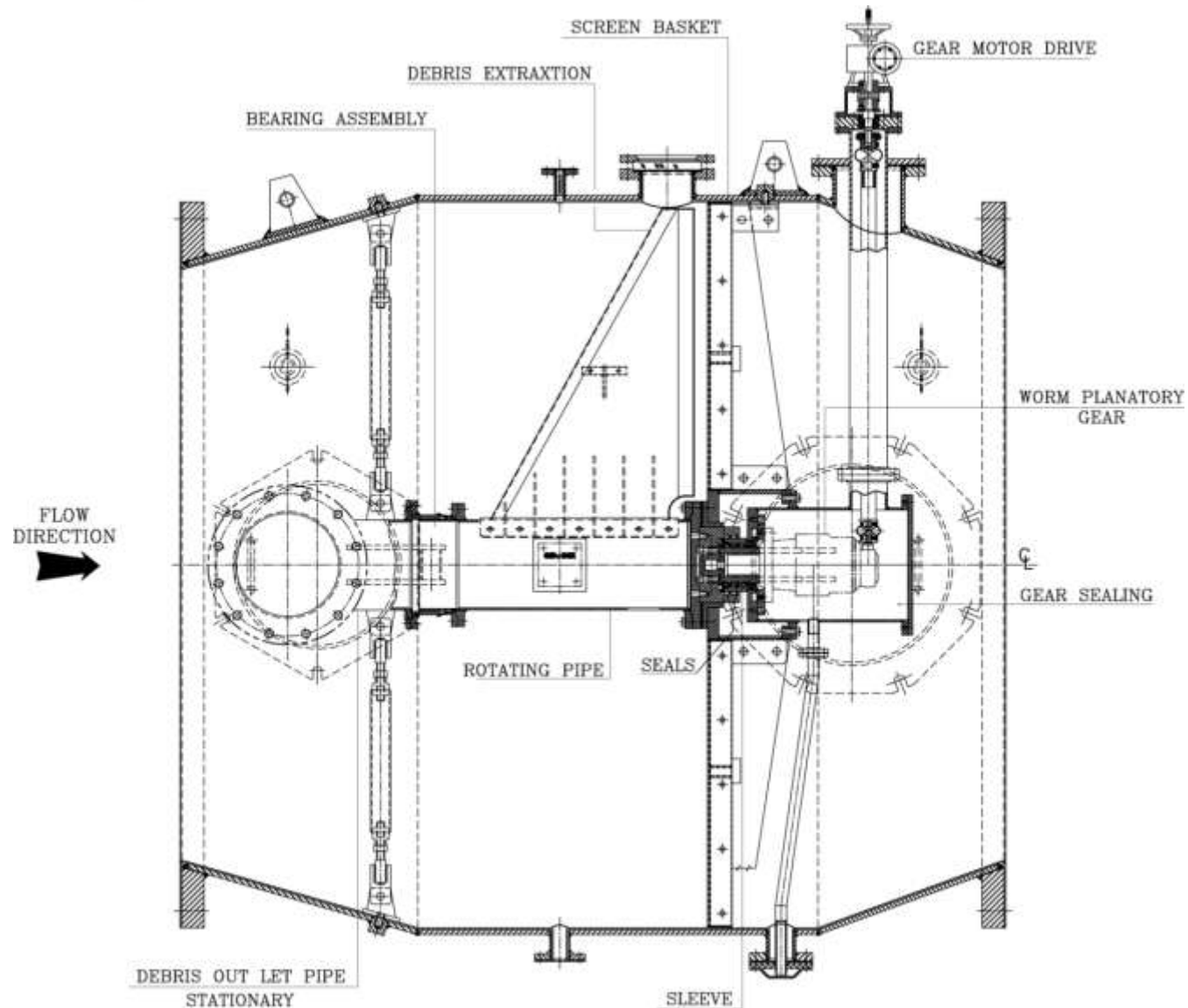
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EP 1 521 625 B1

Wedge Wire Filter

- ❖ Circular segmented Screen design
- ❖ Special Wedge Wire Profile
- ❖ Shorter Length of Filter
- ❖ Low Differential Pressure (20 mbar @ 2m/s)
- ❖ Rugged Construction

GA of Wedge Wire Debris Filter



Wedge Wire Filter



Wedge Wire Filter



DN 2700 size Filter for Lungmen Nuclear Power plant / Taiwan

Elbow Filter



Elbow Type Filter (DN 500) for Taichung Thermal / Taiwan

RETROFIT

International Projects

Plant Details

Sl. No.	Plant	Country	Capacity (MW)	Size	Service	Year of Supply
1	Tuanku Jaafar Power Station – Unit 4, 5 & 6	MALASYA	3 x 120	DN 1100	SW	1992
2	Damanhour Combined Cycle Power Plant	Egypt	1 x 110	DN 900	RW	2000
3	Gardabani Thermal Power Station, Unit 9 & 10	Georgia	2 x 300	DN 1800	CT	1997

(1) Customer TENAGA NASIONAL BERHAD

Date of Report March 1995

Outcome

Improvement of the Vacuum & Fuel Saving

Result:

- Malaysian Ringet $\text{RM}909.79 \times 365 \text{ days} \times 0.8 \text{ availability factor} \times 0.9 \text{ load factor} = \text{RM } 1239,092$
- Savings equivalent to Indian Rs.136 lakhs



Date : 2 March 1995.

To : GEA India

Fax No: 007-91-4342518

Attn : Mr. Mahadavan

From : Station Manager,
Tuanku Jaafar Power Station,
Port Dickson.

Please find enclosed a calculation of cost savings as a result of vacuum improvement for Unit 5 as requested.

Thank you.

(IR. K. KULASEKARAM)
STATION MANAGER
Tuanku Jaafar Power Station
Port Dickson
Malaysia.

Stesen Janaelektrik Tuanku Ja'afar, Peti Surat 26, 71007 Port Dickson, Negeri Sembilan Darul Khusus.
Tel: 06-471199, 471482, 471671, 471732 & 471873. Fax: 06-474555



SAVING IN FUEL OIL FOR AN IMPROVEMENT IN CONDENSER VACUUM BY 15 MBAR FOR UNIT 5 AFTER INSTALLATION OF GEA INDIA CONDENSER ON LOAD CLEANING SYSTEM

Vacuum improvement at 120 MW: 15 mbar

From Stage 3, Vacuum correction curve, exhaust pressure correction factor,
% change in heat rate when vacuum improves by 15 mbar is = - 0.62%

For a load of 120 MW, the Turbine Heat Rate = 8492 Kj/KWH
(Design Value)

Current fuel oil price = RM260/tonne and Gross Calorific Value of fuel oil
= 43,350 Kj/KG.

= Cost of 1GJ of energy = RM6.00

Change in heat rate = - 0.62/100 x 8492
= 52.65 Kj/KWH

Daily Savings

Change in heat rate x installed capacity x fuel oil cost per GJ

52.65 (KJ/KWH x 120 x 1000 x RM6.00/1,000,000

= RM37.91 per hour

= RM909.79 per day

The annual cost savings, assuming a 0.8 availability factor and a 0.9 load factor is

(Saving per day x No. of days per year x availability factor x load factor)

= RM909.79 x 365 x 0.8 x 0.9 = RM239,092

(2) Customer Damanhour Combined Cycle Power Plant

Date of Report 03.12.2012

Outcome

Maintaining load and increase in vacuum

Result:

Before installation of COLTCS - Year 1999

Vacuum -0.869 kg/cm²

Unit Load 104 MW

After installation of COLTCS

Condenser Vacuum -0.89 kg/cm²

Unit Load 109 MW

DAMANHOUR COMBINED CYCLE

FINAL ACCEPTANCE CERTIFICATE

SYSTEM : Condenser On Load Tube Cleaning System And Debris Filter System
PLANT : Damanhour Combined Cycle Power Plant
CONTRACTOR : GEA Energy System (India) Ltd.
OWNER : West delta Electricity Company, Egypt

Issuance date of TOAC : May 07, 2001
End date of warranty period : November 06, 2002

This final acceptance certificate, indicates that GEA INDIA did not have any obligation or comment for the systems.
 The owner accepts to issue this final acceptance certificate.

For Damanhour CCPP

For GEA INDIA




H. ALEEM KHAN



Chief sector, Damanhour power plant

EGYPTIAN ELECTRICITY HOLDING Co.
 WEST DELTA ELECTRICITY PRODUCTION Co.
 DAMANHOUR ELECTRICAL PRODUCTION SECTOR



الشركة القابضة للكهرباء
 شركة غربي دلتا لإنتاج الكهرباء
 قطاع إنتاج دمنهور

December 3, 2012

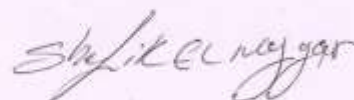
PERFORMANCE CERTIFICATE

This is to certify that M/s GEA BGR Energy System India Limited has supplied Tube Cleaning System of DN 900 size and Debris Filter System of DN 900 size for our Damanhour combined cycle Power Station owned by West Delta Electricity Production Co., in Alexandria Republic of Egypt, in the Year 2000.

All the System of our power station are performing well and working satisfactory.

The condenser vacuum has been maintained as result of system performance since commissioning of the system.

AUTHORISED SIGNATORY



3/12/2012

(3) Customer Gardabani Thermal Power Station

Date of Report 15.10.1998

Outcome

Condenser Efficiency Improved

Result:

Before installation of COLTCS - Year 1996

Condenser Efficiency 86%

After installation of COLTCS - Year 1998

Condenser Efficiency 96%

REPUBLIC OF GEORGIA
ENERGY AND ELECTRIFICATION
DEPARTMENT "SAKENERGO"
PIU-WORLD BANK/EBRD PROJECTS

1 Vekua St. Tbilisi, 380005, Georgia.
Tel/Fax: 995 32 93 38 25

N _____

15 October, 1998

Mr B.G. Raghupathy,
GEA India,

via fax: 91 44 4342518

EBRD POWER REHABILITATION PROJECT
Condenser Tube Cleaning System.

Dear Mr. Raghupathy,

The Condenser Tube Cleaning System,
the Debris Filter, and the
Acid Dosing Systems,

supplied by GEA India, on a turnkey basis, have been operating smoothly since their commissioning in January, 1998. Their use has been limited to the 300 MW Unit 9 at Gardabani, and will be extended to Unit 10, when it's rehabilitation is completed in 1999.

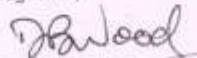
The success of these systems has more than paid for our investment.

After three and one half years of operation, the efficiency of the condenser had been reduced to below 86%. After GEA had cleaned the cooling circuit and condenser tubes, during commissioning of the systems the efficiency had improved to 96%.

With your assistance we have fine tuned the applications and now backflush the Debris Filters every 6 hours, and operate the Condenser Tube Cleaning System for 2 hours per day. Consumption of balls is approximately 400 every 25 days. Using the above regime has increased the efficiency of the condenser to 98%.

We are obviously very pleased with the success of the systems, and thank you for your support to the project at all times.

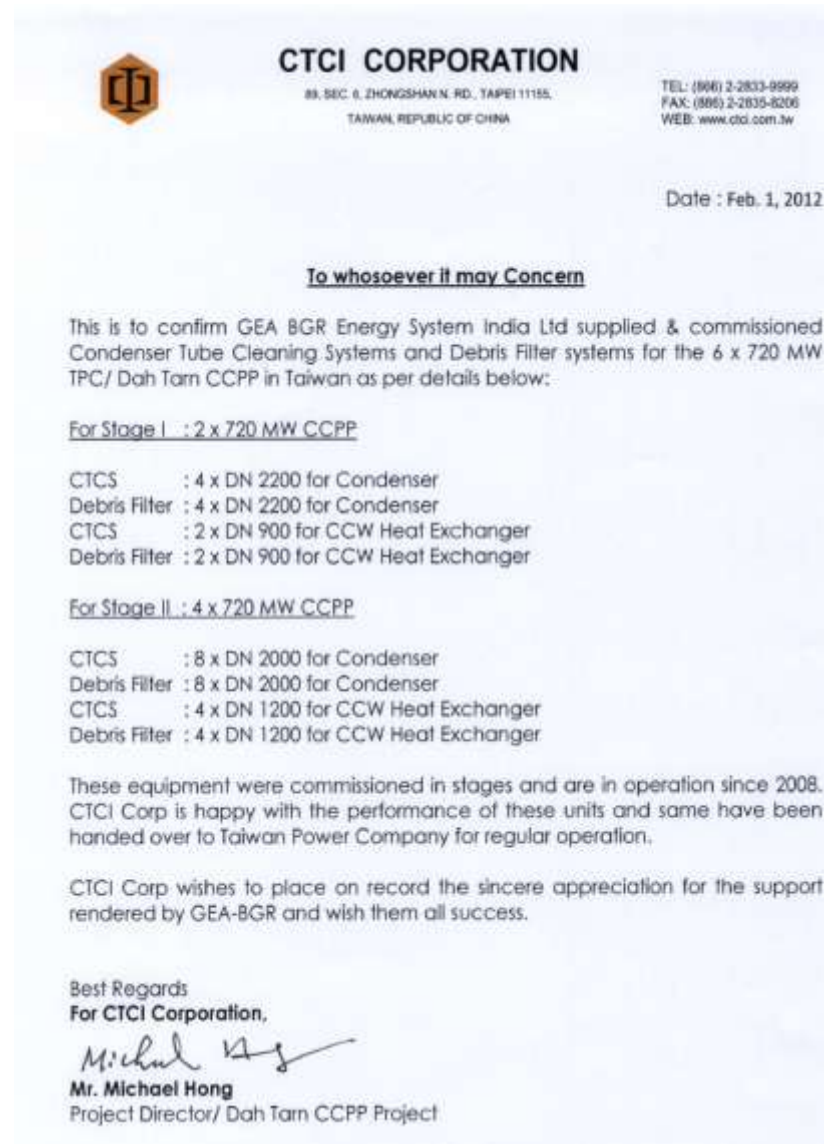
Regards,



Douglas Wood
Project Manager
EBRD Consultant.

Appreciation Letters

Letter of Appreciation – 4000 MW CCPP



Fuel cost saving with CTCS



SAVING IN FUEL OIL FOR AN IMPROVEMENT IN CONDENSER VACUUM BY 15 MBAR FOR UNIT 5 AFTER INSTALLATION OF GEA INDIA CONDENSER ON LOAD CLEANING SYSTEM

Vacuum improvement at 120 MW : 15 mbar

From Stage 3, Vacuum correction curve, exhaust pressure correction factor,
% change in heat rate when vacuum improves by 15 mbar is = - 0.62%

For a load of 120 MW, the Turbine Heat Rate = 8492 KJ/KWH
(Design Value)

Current fuel oil price = RM260/tonne and Gross Calorific Value of fuel oil
= 43,350 KJ/KG

= Cost of 1GJ of energy = RM6.00

Change in heat rate = - 0.62/100 x 8492

= - 52.65 KJ/KWH

Daily Savings

Change in heat rate x installed capacity x fuel oil cost per GJ

52.65 (KJ/KWH x 120 x 1000 x RM6.00/1,000,000

= RM37.91 per hour

= RM909.79 per day

The annual cost savings, assuming a 0.8 availability factor and a 0.9 load factor is

(Saving per day x No. of days per year x availability factor x load factor)

= RM909.79 x 365 x 0.8 x 0.9 = RM239,092

Saving of US\$ 65000 p/a on a 120 MW power plant

Letter of Appreciation – MHI



Letter of Appreciation - MEW, Kuwait



وزارة الكهرباء والماء

Ref : الإشارة :

Date: 10/04/2011 التاريخ :

الموافق :

Letter of acknowledgement

As discussed and agreed upon with Doosan and MEW, GEA BGR ENERGY SYSTEMS LIMITED had carried out modification works in the DN 1800 Ball Strainer installed in the D4 unit of Sabiya Desalination Plant. The modifications were required, in order to make the system suitable for site CW conditions.

MEW acknowledges the significant efforts put in by GEA-BGR in modifying the system and making it suitable for site CW conditions. MEW has noted that ball recovery in the modified system is consistently above 99% for the last 20 days. MEW would like to observe the performance over the next 3 months and issue a final performance certificate to GEA-BGR.

"MEW would like to place on record its appreciation for the efforts rendered so far by GEA BGR ENERGY SYSTEM LIMITED.

Eng. Bader Al Sane
MEW Project Manager
Sabiya Distillation Project (I, II & III)
Ministry of Electricity & Water - Kuwait



Performance Certificates

METALEX

SUMISHO METALEX CORPORATION
1-10, KANDA, ODAWA-MACHI,
CHYODA-KU, TOKYO, 101, JAPAN
TELEX 2320000 SUMTOKU

EHCOT-0415/F7
APR 15, 1997

MINUTES OF MEETING HELD BETWEEN GEA ENERGY SYSTEM(INDIA)LTD. AND
SUMISHO METALEX CORPORATION, AT SUMISHO METALEX CORPORATION TOKYO HEAD
OFFICE ON APR 15, 1997.

SUB : COMMISSIONING OF LOAD TUBE CLEANING SYSTEM - TOSHIBA TEST CONDENSER

GEA ENERGY SYSTEM(INDIA)LTD. REP MR.VIJAYARAJ VISITED TO JAPAN ON
APR 09, 1997 TO COMMISSIONING THE TUBE CLEANING SYSTEM IN TOSHIBA NISHIWAKI
WORKS.

TUBE CLEANING SYSTEM COMMISSIONED BOTH MANUAL AND AUTO WITH ALL
INTERLOCK AND DEMONSTRATED ABOUT TUBE CLEANING SYSTEM TO TOSHIBA AND
SUMISHO METALEX CORPORATION OFFICIAL
CLEANING BALLS ARE CIRCULATED THROUGH THE SYSTEM ON APR 14/15, 1997.
THE BALL COLLECTION RATE IS 96PCT, 99PCT, 100PCT RECOVERY.
TOTAL SYSTEM, AND RECOVERY PERFORMANCE IS SATISFACTORY.
THE INSPECTION REPORTS WITH TOSHIBA SIGNATURE ARE ENCLOSED.

GEA ENERGY SYSTEM(INDIA)LTD.

S. VIJAYARAJ, SR-MANAGER
FIELD ENGINEER

SUMISHO METALEX CORPORATION.

K. OTANI, MANAGER
PLANT MATERIAL TEAM

TOSHIBA CALLIDE 'C' SITE OFFICE

TOSHIBA INTERNATIONAL CORPORATION PTY. LTD.
A.C.N. 001 555 088
CALLIDE POWER PLANT CONSTRUCTION SITE
VIA CALLIDE DAM ROAD, BRISBANE QLD 4375
TELEPHONE: (07) 4997 6213, FACSIMILE: (07) 4992 6213
LOCKED BAG 5629, PARRAMATTA, N.S.W. 2124 AUSTRALIA

7 December, 2001

Attention: GEA Energy System (India) Limited

To Whom It May Concern:

GEA India supplied the Tube Cleaning System for the Australian Callide "C" Project, 2
X 420 MW Coal fired Units. The system has now been in operation from the 12 of December
2000 and has operated at a ball recovery rate of greater than 99% and from an operational
point of view the system performance has been excellent and to our/owners satisfaction.

Best Regards,

Engel Van de Wetering
Commissioning Engineer

TOSHIBA INTERNATIONAL CORPORATION PTY.LTD.



POWER DEPARTMENT

Performance Certificates



1(1)

Performance Certificate

Date: August 16th, 2011

This is to certify that the equipment as per details attached at below table is installed and commissioned in Tanjung Jati B power plant at Unit-1&2 in the year of 2005 and in being operation until now successfully without any major trouble/incident.

Name of Equipment	Condenser On load Tube Cleaning System
Area of Installation	Condenser
Location Unit	Unit 1&2
Cooling water Pipe Size	DN3500
Year of Installation and commission	2005
Name of Supplier	GEA BGR ENERGY SYSTEM INDIA LIMITED
Supplied Through	Foster Wheeler
Average Ball Recovery	90%
Overall Performance	Satisfactory

The above certificate is being issued to GEA BGR ENERGY SYSTEM INDIA LIMITED upon their request.

For TJB

Signature: 
 Name: *Hel Gersonite*
 Seal: *Mech. Eng.*

Performance Certificates

Ministry of Electricity & Energy
Egyptian Electricity Holding Company
Middle Delta Electricity Production Co.
New El-Atf project



وزارة الكهرباء والطاقة
الشركة القابضة للكهرباء
شركة وسط الدلتا لإنتاج الكهرباء
محطة كهرباء أيتف الجديدة

November 25, 2012

M/s.GEA BGR Energy System India Limited
Chennai, India.

Dear Sirs,

PERFORMANCE CERTIFICATE

Condenser On Line Tube Cleaning Systems of DN 1800 size and Debris Filter Systems of DN 1800 size were supplied and commissioned by your company for our El-ATF Power Station (owned by Middle Delta Electricity Production co., in Republic of Egypt) in the year 2008 for Unit # 1.

All the Systems performance of our power station is extremely satisfactory.

Best Regards

AUTHORISED SIGNATORY
ENG/ Mohamed El Saeid El Abd

MDEPCo., El-Atf Project Manager

Ministry Of Electricity & Energy
Egyptian Electricity Holding Co.
Cairo Electricity Production Co.
El-Tebbin Power Planet
Tel.25010251 Fax: 25010250



وزارة الكهرباء والطاقة
الشركة القابضة للكهرباء
شركة القاهرة لإنتاج الكهرباء
محطة كهرباء التبين البخارية
ت: ٢٥٠١٠٢٥١ فاكس: ٢٥٠١٠٢٥٠

November 21, 2012

PERFORMANCE CERTIFICATE

This is to certify that M/s.GEA BGR Energy System India Limited have supplied Tube Cleaning Systems of DN 1800 size and Debris Filter Systems of DN 1800 size for our 2 x 350 MW EL Tebbin Power Station, owned by Cairo Electricity Production co., in Republic of Egypt, in the year 2007 for Unit # 1 and 2.

All the Systems of our power station are performing extremely satisfactory since commissioning.

AUTHORISED SIGNATORY


21. 11. 2012







01/12/2012

To whom so ever it may concern

We confirm that Condenser Tube Cleaning systems and Debris Filter Systems of size DN 1800 have been supplied and commissioned by M/s GEA BGR Energy System India Ltd for our 2 x 650 MW Abu Qir Thermal Power Project in Egypt. The systems are working alright and the performance found to be satisfactory.

Yours sincerely

Yasuhiro Saito
Site Manager




**MAHARASHTRA STATE POWER GENERATION CO. LTD.,
Thermal Power Station, Parli-Vajnath**

Gram: "POWERGRID"
Parli-Vajnath.
Phone No.: 02446-222357, 58, 59
FAX No. : 02446-222492
Email: blr_ccegenrli@sancharnet.in



Office of the Chief Engineer
Parli Thermal Power Station,
M. S. Power Generation Co. Ltd.,
Parli-Vajnath 431520 (Dist- Beed)
Maharashtra State.

Ref No: Dy.C.E./250MW/NPTPS/TM/No. **No 10869**

Date: 11/09/2012
14 SEP 2012

CERTIFICATE

This is to certify that M/s.GEA BGR Energy System have supplied Condenser On Load Tube Cleaning Systems of Size DN 2200 for Units # 6 & 7 (250 MW) at NPTPS, Parli-V.

The performance of Condenser On Load Tube Cleaning System was reviewed & checked by representative of M/s GEA BGR from dated 31/07/2012 to 07/08/2012 and found satisfactory.

The service support provided by M/s.GEA BGR Energy System India Limited from the date of commissioning of the system is found to be satisfactory.

This performance certificate is issued as per request of M/s GEA BGR Energy System India Limited vide application Dtd. 08/08/2012.



**Chief Engineer
TPS, Parli-Vajnath**



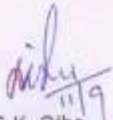
न्यूक्लियर पावर कॉर्पोरेशन ऑफ इण्डिया लिमिटेड
NUCLEAR POWER CORPORATION OF INDIA LIMITED
 रावतभाटा राजस्थान साईट इकाई-3&4
RAWATBHATA RAJASTHAN SITE UNIT-3&4



NO.RR Site Unit-3&4/OPN/2012/S/ DATE: 11.09.2012

CERTIFICATE

This is to certify that **CONDENSER ON LINE TUBE CLEANING SYSTEM** was supplied by M/s GEA-BGR Energy System India Limited to RAPS-4 (Line size DN 1800 Lake water application) 220 MWe units, in 1994 and commissioned in 2000. The system was operated intermittently till the year 2003. The system was re-commissioned in 2011 after rectification of problem which was causing escape of balls. Since then the system operation & performance is found to be satisfactory till date.


S.K. Ojha
 Senior Operation Engineer
 RR Site Unit-3&4


S. K. OJHA
 Senior Operation Engineer / G
 NPCL

To,
 GEA-BGR ENERGY SYSTEM INDIA LTD.
 443, ANNA SALAI, TEYNAMPET,
 CHENNAI-600018

न्यूक्लियर पावर कॉर्पोरेशन ऑफ इण्डिया लि.
NUCLEAR POWER CORPORATION OF INDIA LTD.
 (A Government of India Enterprise)
 तारापुर परमाणु विद्युत केंद्र 3-4
TARAPUR ATOMIC POWER STATION 3-4
 तारापुर महाराष्ट्र स्थल
Tarapur Maharashtra Site
 पो : TAPP, Boteer (WR), Dist. Thane, Maharashtra - 401 504
 E-mail : rajendragupta@npcl.co.in,
rajendragupta@taps34.com








संख्या : टीएपीएस-3/व/प्रचालन/०९१००/१२/एस/ दिनांक : 31/08/2012
 No. : TAPS-3&4 /OPN /09100/12/S/ Date : 31/08/2012

CERTIFICATE

This is certified that On Load Tube Cleaning Systems were supplied by M/S GEA BRG Energy System India Limited to TAPS-3&4 (Line Size DN 2000 Sea water application) 500 MWE units in the year of 2004.

The systems were commissioned in the year of November-2005 and are in service till date.

The systems operation in both the units is satisfactory.


 (आर.के. गुप्ता R. K. Gupta)
 प्रचालन अधीक्षक Operation Superintendent

To,
 GEA-BRG ENERGY SYSTEM INDIA LTD.;
 443 ANNA SALAI, TEYNAMPET,
 CHENNAI - 600018

EGYPTIAN ELECTRICITY HOLDING COMPANY
MIDDLE DELTA ELECTRICITY PRODUCTION COMPANY
(MDEPC)
NUBARIA III POWER STATION COMBINED CYCLE



الشركة القابضة للكهرباء
شركة وسط الدلتا لإنتاج الكهرباء
محطة توليد الكهرباء النوبارية الجديدة

Sidi Krir Power Plant
750 MW Combined Cycle
Power Station Project



محطة كهرباء سيدي كير
مشروع محطة الدورة المركبة
قوة ٧٥٠ م.و

November 22, 2012

M/s. GEA BGR Energy System India Limited
Chennai, India.

PERFORMANCE CERTIFICATE

This is to certify that we have the following equipments supplied by your company in our 750 MW Nubaria Combined Cycle Power Station owned by Middle Delta Electricity Production co., in Republic of Egypt.

Tube Cleaning Systems = DN 1800 size

Debris Filter Systems = DN 1800 size

Year of supply = 2000.

All the Systems of our power station are performing well and working satisfactorily since commissioning.

AUTHORISED SIGNATORY



TO: WHOMSOEVER IT MAY CONCERN

DATE: October 2, 2012

This is to certify that M/s. GEA BGR Energy System India Limited has supplied two nos. of Condenser Tube Cleaning System of size DN 1800 and Debris Filter system of size DN 1800 for our 750 MW Combined Cycle Power Station at Sidi Krir owned by West Delta Electricity Co. in Alexandria, Egypt.

The systems are performing extremely satisfactorily since commissioning in May 2010

This certification issued under M/s. GEA BGR Energy System India Limited request without any responsibility to West Delta Electricity Co.

Eng : Mohamed.M.M. Darwish.
Chief Sector




October 2, 2012



الشركة القابضة لكهرباء مصر
شركة غرب الدلتا لإنتاج الكهرباء
محطة كهرباء سيدى كرير

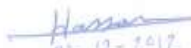
December 02, 2012

PERFORMANCE CERTIFICATE

This is to certify that M/s.GEA BGR Energy System India Limited has supplied
Two nos. of Tube Cleaning Systems of DN 500 size for our 2 x 5000 ton / day
sidi krir desalination plant in Republic of Egypt.

The Tube Cleaning Systems of our Desalination plant are performing
satisfactory since commissioning in the year 1998.

Eng :Hasssan El Sayed Abd Elaziz


02-12-2012
General Manager

บริษัท โกลว์ พลังงาน จำกัด (มหาชน)
GLOW ENERGY PUBLIC COMPANY LIMITED
199 Eimke Tower, 38th Floor - Park Wing, South Sathorn Rd, Watthana, Sathorn, Bangkok 10120, Thailand
Tel. +66 2 670 1500 - 1 Fax. +66 2 670 1548 - 9



Performance Certificate for COLTCS & Debris Filter

Date: 31.08.2011

Project : Glow 115 MW CFB # 3, Rayong, Thailand
System : Condenser On Load Tube Cleaning System & Debris Filter System
Supplier : GEA-BGR Energy System India Limited

Condenser On Load Tube Cleaning System [Size: DN 1500] and Debris Filter Systems [Size: DN 1500] were supplied by GEA – BGR Energy System India Limited for Sea Water application at Glow Site – Thailand.

Ball Recovery in COLTCS is more than 95% and Debris Filter Differential Pressure is maintaining between 3 to 5 mbar.

Performance of the above said systems are observed and found satisfactory since August 2009 from the date of Commissioning.

Regards,




- 1 SEP 2011

Tananchai Chaisrakaew
Project Manager
Glow Energy Public Company Limited
11, I-5 Road Map Ta Phut Industrial Estate,
Muang, Rayong 21150.



Date: 19/10/2012

TO WHOM SO EVER IT MAY CONCERN

Performance Certificate for Debris Filter and TCS

GEA BGR has supplied tube cleaning & Debris filters (Size DN 1800) for 250 MWs plant in Unit no. 8. For sea water application.

The both TCS & debris filter performance is satisfactory since commissioning in 2009. The after sales service & spares availability provided by GEA BGR is satisfactory



S R Kamat
Head Mechanical Maintenance

S. R. KAMAT
Asst. Gen. Manager
The Tata Power Co. Ltd.
Trombay, Mumbai-400 074.

Thank you