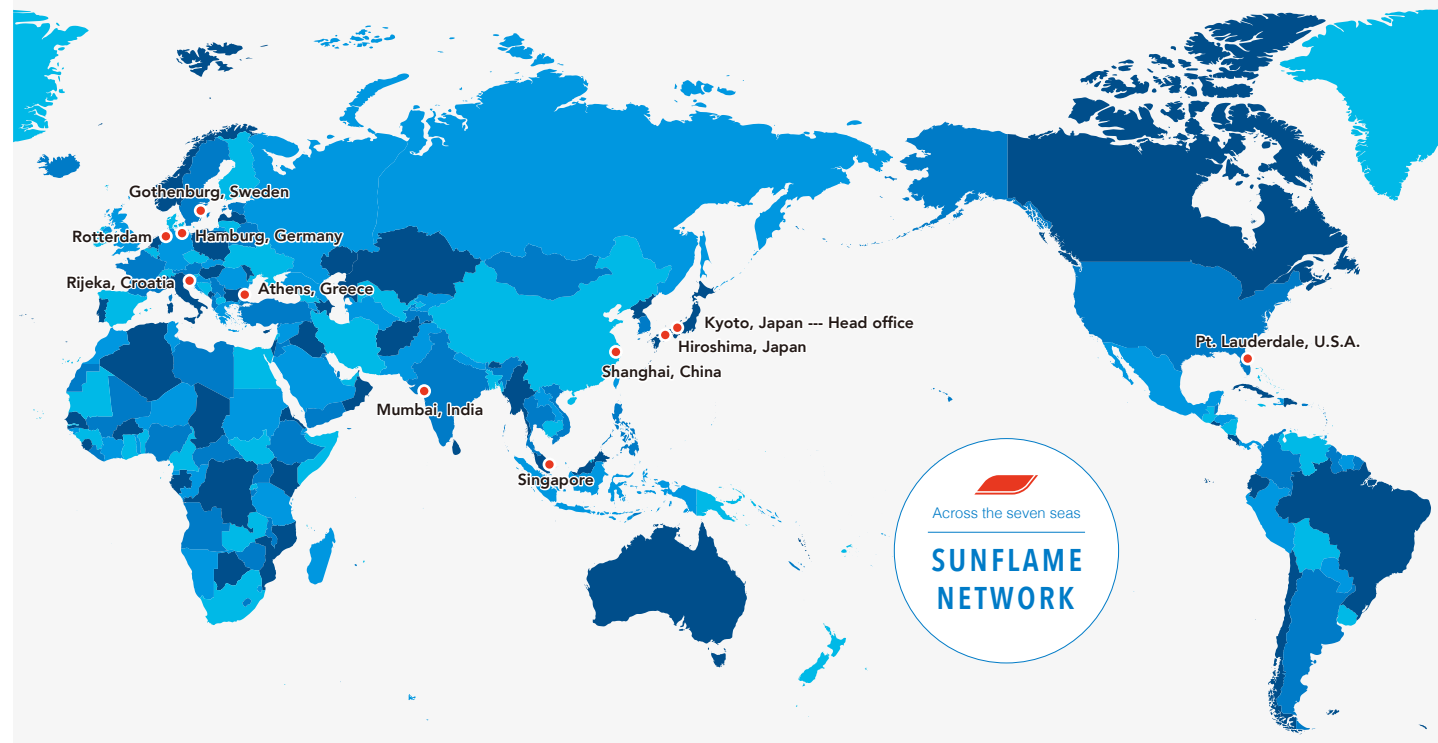


SERVICE NETWORK



History

- 1968 "Osaka Sunflame Co., Ltd" founded as an oil burner maintenance company
- 1969 Started oil burner production and became a manufacturer
- 1972 Started manufacture of waste oil incinerators
- 1980 Released the high-performance rotary cup burners "Type SSR" and "Type R"
- 1982 Renamed company to "Sunflame Co., Ltd." and purchased factory in Kyoto
- 2001 Released the 3rd generation rotary cup burner "Type SDR"
- 2005 Obtained the ISO9001 standard through NK;
Moved company headquarters and factory to Uji, Kyoto following expanded business
- 2006 Developed a control system for large size auxiliary boilers for VLCCs
- 2008 Released the 3rd generation rotary cup burner "SDR-1500"
Developed and launched new combustion control system with graphic touch panel
- 2009 Released the Emulsion Combustion System (ECS)
- 2014 Released the 3rd generation rotary cup burner "SDR-350", "SDR-500", "SDR-700"
Developed the LNG-compatible dual fuel burner series "SDR-G" for oil and gas;
Expanded main factory to accommodate new test facility
- 2016 Released the ceramic tile refractory for incinerators
- 2017 Developed the next-generation control system equipped with logging and network functions
- 2018 Released the automatic fuel switch system for MGO and HFO;
Co-developed a level sensor check-up system and preheat support system with a client for dry boiling prevention
- 2019 Delivered the first dual fuel burner for oil and gas, the "SDR-G200" unit
- 2020 Began sales and operation of the "Sunflame Smart Support System",
a user support system using ship-to-shore communication
- 2021 Developed GCU for Gas Carrier Vessels and Gas Fuel Vessels
Sunflame Smart Support System was certified as a 'Product & Solutions' product under NK's 'Innovation Endorsement' program as the first product from a marine equipment manufacturer
Office renovation
- 2023 In-house development and start of operation of building control system "MaCo" based on equipment control technology;
Ammonia combustion test facility begins operation

HISTORY of SUNFLAME



Marine incinerator
(Equipped with rotary cup burner)



1-30, Nishinohata, Okubo-cho, Uji, Kyoto 611-0033, Japan

TEL.+81-774-41-3310

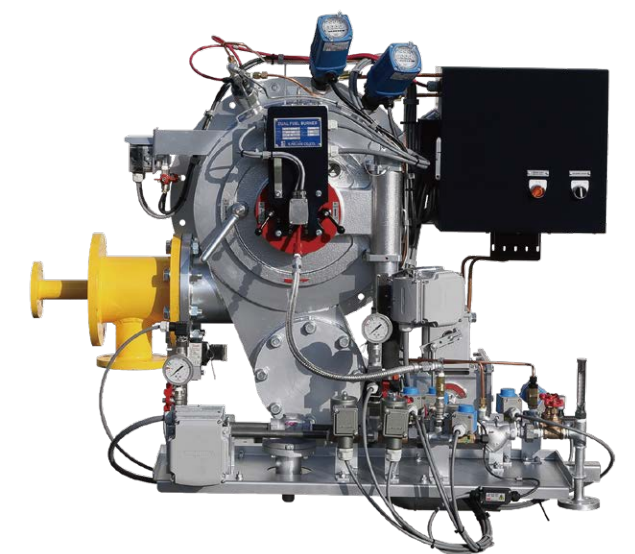
FAX. +81-774-41-3311 ✉ info@sunflame.net

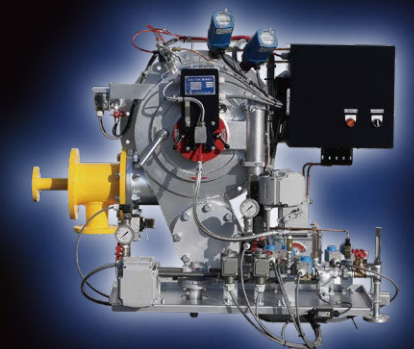


<http://www.sunflame.net>

BE-2407-32A

ROTARY CUP BURNER





ROTARY CUP BURNER

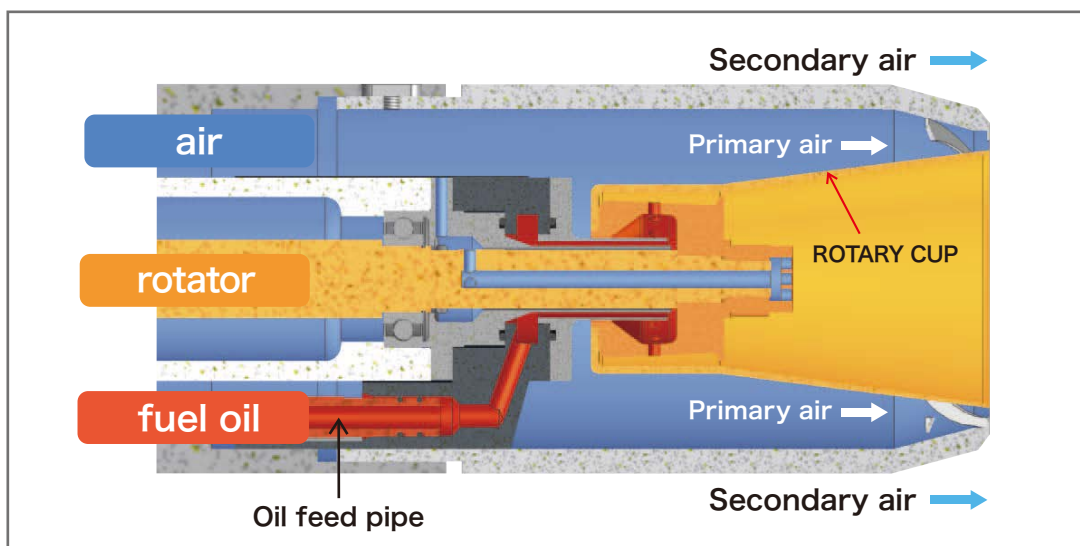
Sunflame's Core Combustion Technology

Auxiliary boilers are crucial on-board devices which operate during berthing and sailing. The burner apparatus, which serves as the auxiliary boiler's heat source, must guarantee reliable operation for an extended duration of time even under demanding conditions at sea. With increasingly strict international environmental regulations, ocean-going vessels today must be compatible with different fuel types suitable to each maritime zone. Sunflame's Rotary Cup Burners are capable of atomizing fuel consistently irrespective of the fuel's quality or viscosity, including challenging fuels like waste oil. Moreover, the pivotal elements of combustion—combustion rate, atomizing air pressure and volume, and rotary cup rotation speed—are all modifiable via software. This adaptability ensures stable combustion throughout all phases of ship operation, eliminating the need for intricate manual adjustments. These capabilities are not only beneficial for managing conventional heavy fuel oil but also for gaseous fuels such as LNG and ammonia, as well as alternative fuels such as methanol. With decarbonization of the marine industry in mind, Sunflame is committed to product development in response to customer demand using Rotary Cup Burners.

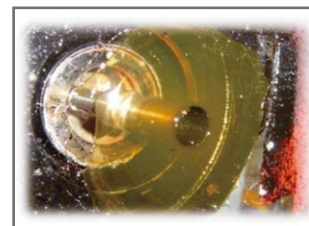
Mechanism

A Rotary Cup Burner is the ideal burner for marine auxiliary boilers, designed for efficient combustion by controlling the rotation of the cup and two types of combustion air.

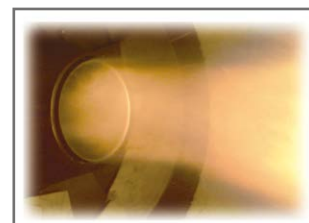
Operation



1 Fuel oil is conveyed into the cup that is rotating at high speed.



2 Centrifugal force forms a thin film of oil.



3 High-pressure air sprays oil for combustion.

Advantages



Safety and stability

- The risk of fire caused by dispersion is reduced due to low atomization pressure at 0.15-0.5 MPa.
- Enables stable combustion over an extended period of time with little risk of misfire from clogging.
- Compatible with a wide range of fuels such as HFO, MGO, biodiesel, methanol, and waste oil. (LNG and ammonia can also be combusted) (when equipped with gas nozzles).



Energy saving

- Achieves fuel efficiency with wide turn-down ratio: the amount of fuel for combustion is controlled to be minimal based on steam demand.
- Minimizes heat loss in the boiler furnace by eliminating the need for surplus combustion air.



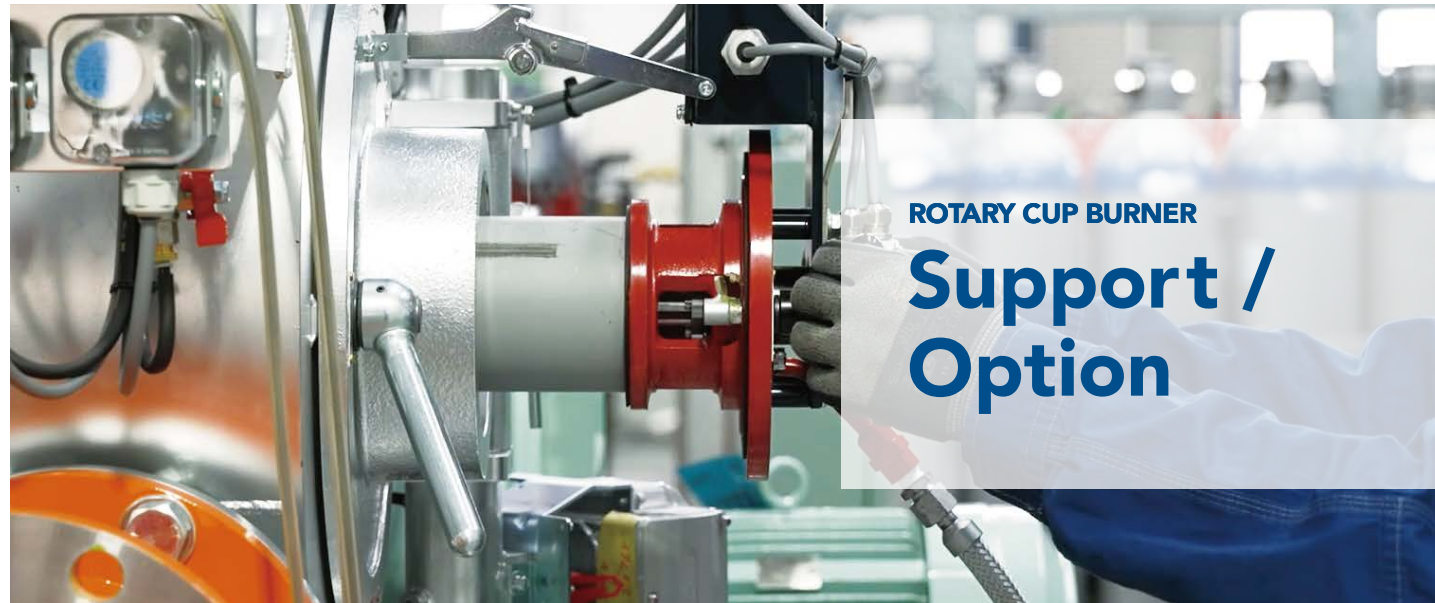
Maintainability

- Number of consumable parts is reduced to save time and effort for maintenance
- Maintenance is simplified because the motor is directly connected to the shaft of the cup, the piping unit is a block unit and the main burner unit is attached to a hinged door, making it easy to open.



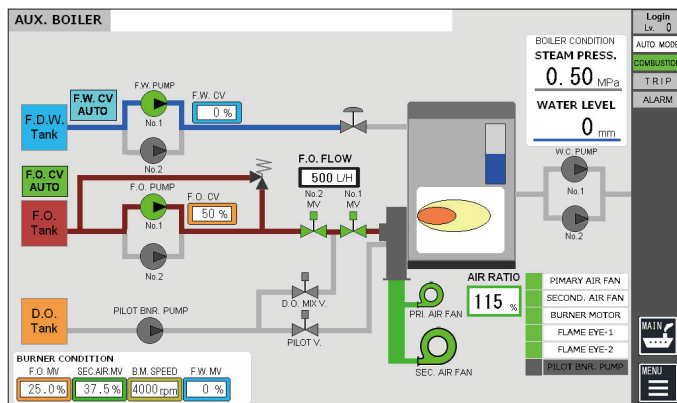
Usability

- Touchscreen displays the operation status, alarms, and operating instructions.
- Redundant system with PLC and relay type control for semi-automatic operation even in case of PLC failure.
- Gauge instruments are attached to the burner body rather than the pipeline to enhance control precision.



Support / Control Panel

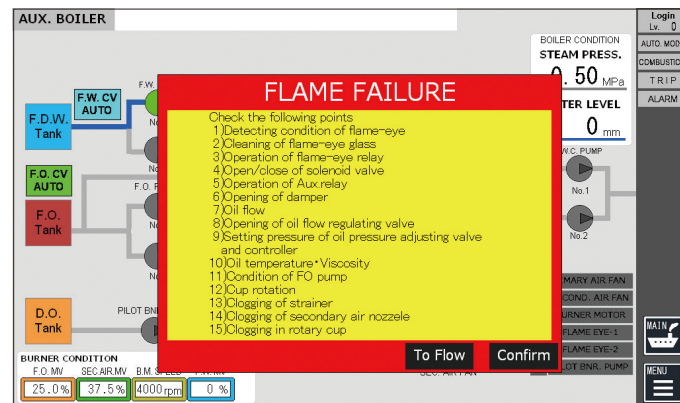
The control panel is equipped with an intuitive touchscreen to visualize its multifunctional auto-control system. By enhancing the control panel's operability, we not only improve its functionality but also ensure that operational data can be used to provide optimal support for operations and prevent potential issues.



Sample image of main screen

① Data logging function

Precise troubleshooting can be provided by visualizing operational data, which enables a clear understanding of the trouble situation.



Sample image of troubleshooting display

② Troubleshooting display

Prompt resolution onboard is ensured by displaying the appropriate response methods for each incident.

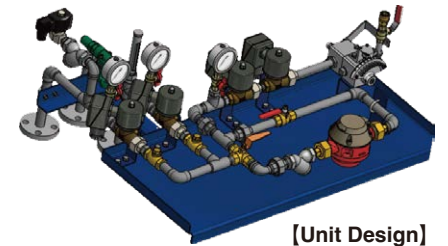
Option / Sunflame Smart Support System



Real-time IoT technology captures the vessel equipments' operational data and visualizes the operational status. We offer suitable maintenance strategies, trouble prevention, and operational guidance that enhances fuel efficiency by analyzing the parts sales history and service reports. (Network facilities are required on the vessel side to conduct ship-to-shore communication.)

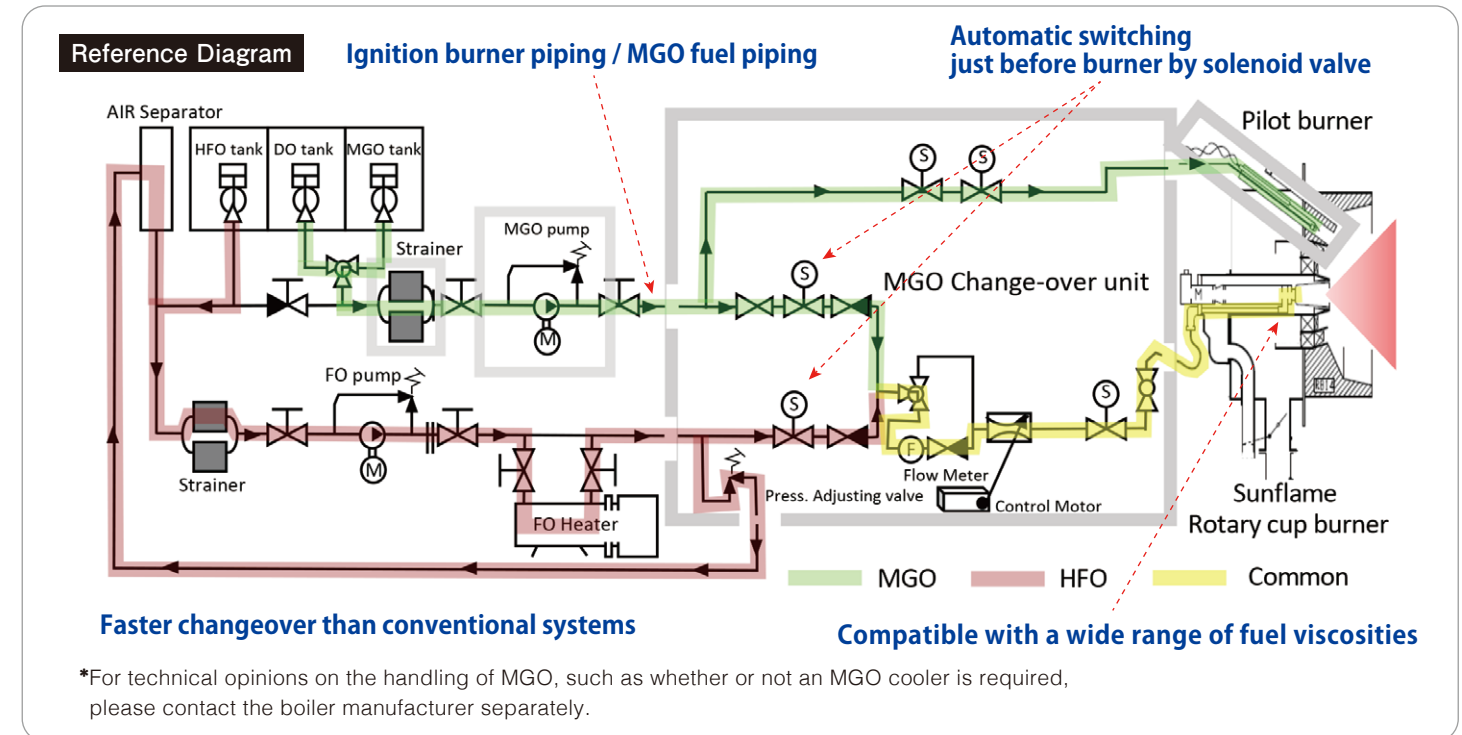
Option / MGO Automatic Switching Unit

Boiler burner fuels such as HFO and MGO can be changed easily with a single switch to comply with sulfur oxide emission regulations in both Emission Control Areas (ECAs) and Non-ECA zones.



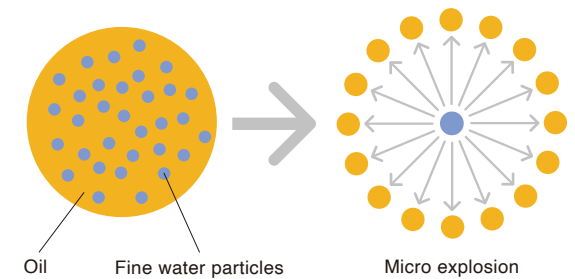
[Unit Design]

By using the MGO main piping also for the ignition burner piping, the need for pipe modification is minimized, and fuel waste is reduced by switching fuels just before the burner. Fuels can be switched quickly and without error because complex valve operations are not required.



Option / Emulsion Combustion System (ECS)

This system creates a state close to theoretical combustion by introducing water into the fuel oil and creating finely atomized oil using the micro-explosions from water evaporation.



It is possible to maximize the characteristics of a rotary cup burner, which excels in the combustion of high-viscosity oil and fine adjustment of air-fuel ratio.

By reducing excess air, it is possible to decrease heat loss within the boiler furnace, thus improving combustion efficiency and reducing the environmental impact of emissions such as NOx.

Additionally, as it is designed for installation in auxiliary boilers, it is compact and can be installed with minimal changes to the heavy oil piping facilities and layout, aside from an additional water supply piping.

Benefits

Fuel consumption rate	CO2/SO2 emission rate	7.4% decrease
7.4% decrease	NOx emission rate	20% decrease
	CO emission volume	50% decrease

*The data listed on this page are our company's test values and are not guaranteed.

Combustion principle

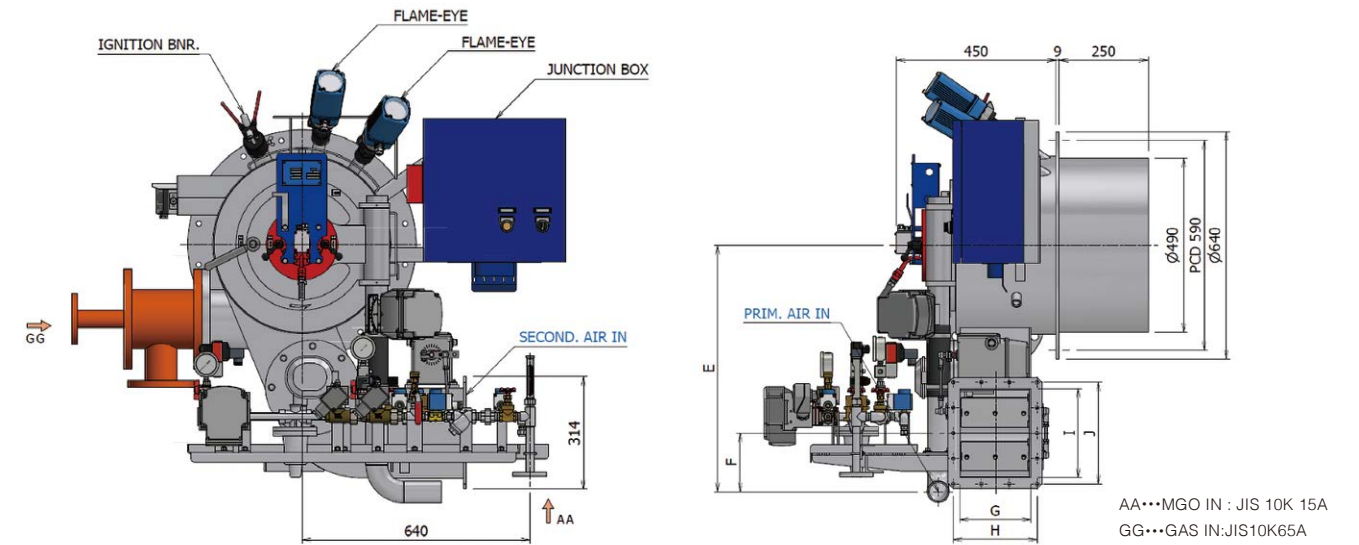
- Fine water particles are introduced into the fuel oil. (20% water is added)
 - Fuel oil is dispersed into fine particles when the water particles explode by evaporating in the heated boiler furnace.
 - Finer oil particles increase the total contact area with oxygen, thereby optimizing the combustion process.
- ⇒ By improving combustion efficiency, excess air is reduced and boiler heat loss is minimized. (By combustion air damper control in accordance with intake air temperature, etc.)



ROTARY CUP BURNER
**DF BURNER /
GCU / GUV**

DF(Dual Fuel) Burner Outline Drawing

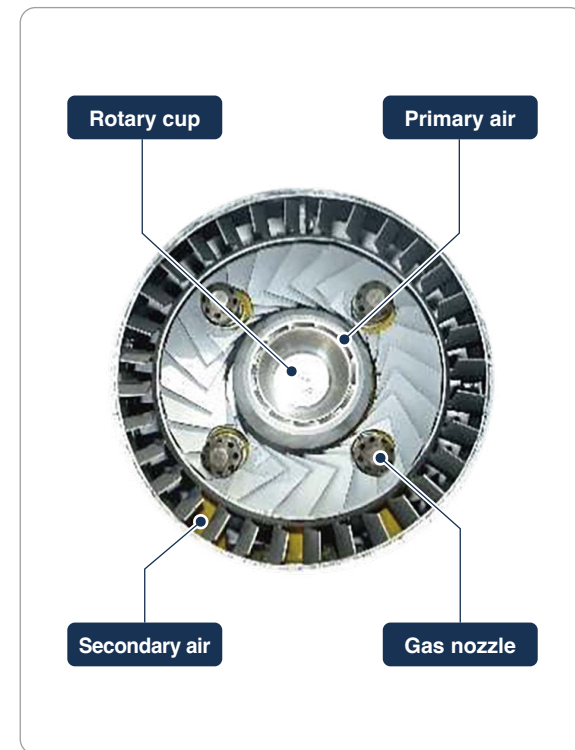
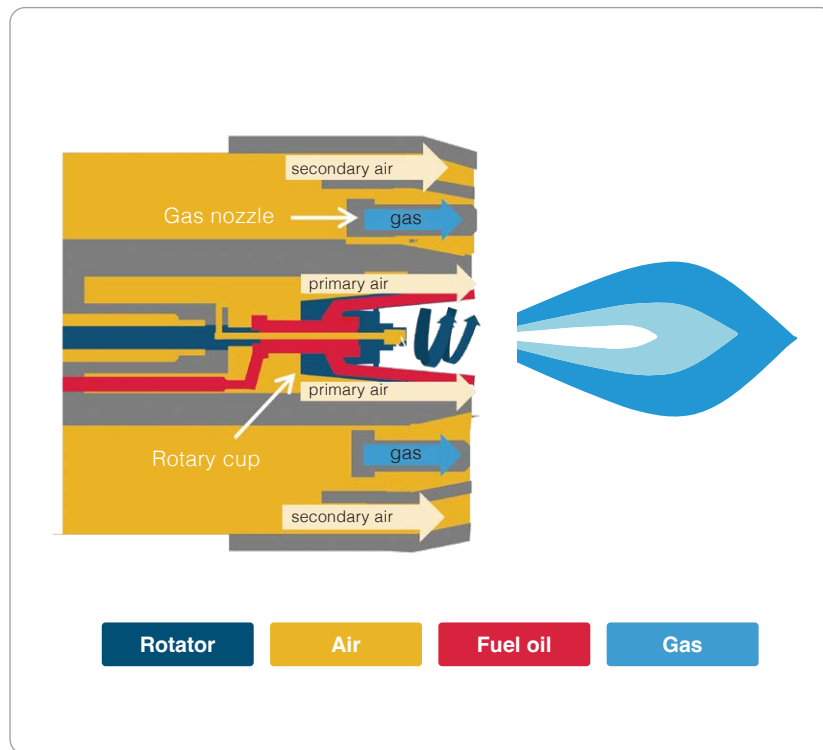
SDR-G200 / G250



	E	F	G	H	I	J	K
G200	693	165	200	236	250	286	314
G250	753	215	200	236	270	306	334

DF (Dual Fuel) Burner

This burner can use low-carbon alternative fuels such as LNG alongside oil fuels.
A rotary cup burner combined with a gas nozzle is capable of using both liquid and gas fuels.



Features

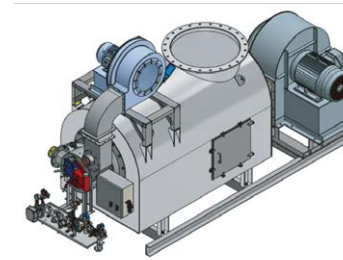
- Feedback control by O2 sensor (automatically adjusts gas volume in response to changes in heat value)
- Capable of processing BOG as well as N2 inclusive gas (N2 100% is supported)
- Wide turn-down ratio for combustion volume decreases the number of burner starts/stops and oil volume for combustion assistance
- Data transmission function is a standard feature

• Combustion modes

- 1 Oil Combustion
- 2 Gas Combustion
- 3 Dual Fuel Combustion
- 4 GCU Mode (Mixed Combustion)

Gas Combustion Unit (GCU)

This equipment is used for the on-vessel treatment of gases generated by LNG and other low-temperature liquefied gas operations.



Features

- Combustion control according to gas pressure and inert gas concentration
- Uses the latest combustion technology developed for auxiliary boilers
- Automatic control of oil for combustion assistance injection
- Minimum installation area



Gas Valve Unit (GVU)



This is a supply and control device for LNG and other gas fuels. The unit consists of gas fuel supply piping, control valves and safety devices, and can supply fuel to Sunflame's DF burner, GCU, and other gas-operated equipment on board.

Features

- Equipped with gas valve leak check function
- Open or enclosure type can be selected
- Stable gas fuel supply pressure
- Connection to external equipment via EtherCAT connection available
- GVU for engines also available

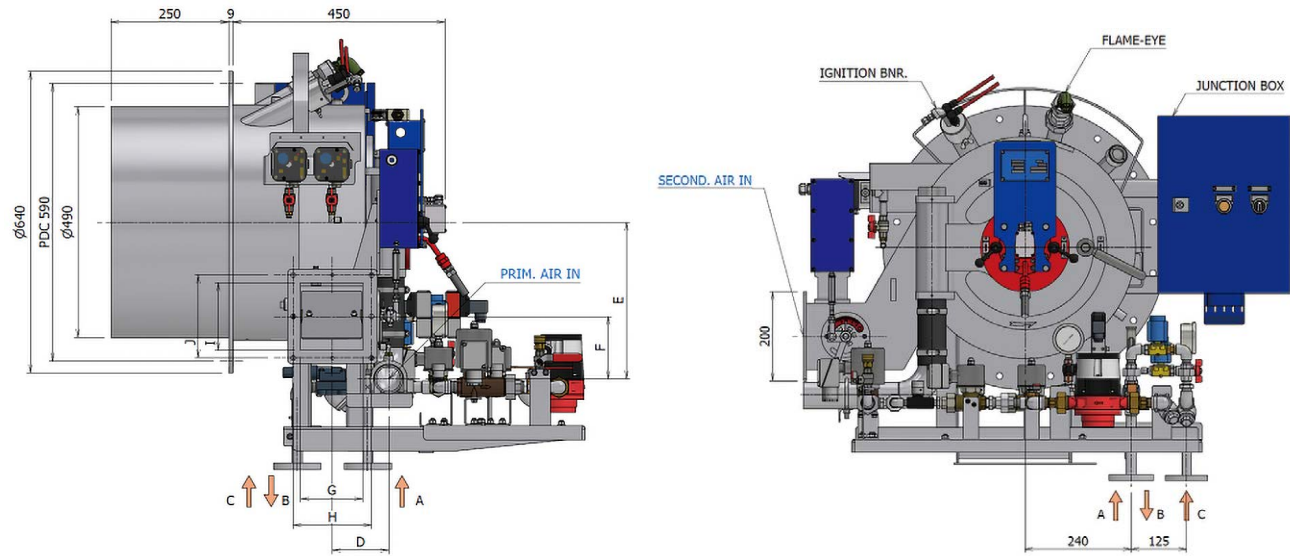


Specifications

Rotary Cup Burner Type		SDR-1	SDR-1.5	SDR-2	SDR-2.5	SDR-350	SDR-500	SDR-700	SDR-1000	SDR-1500	R-25D	R-40D	
											R-25	R-40	
Rotary Cup Burner	Capacity (kg/hr)	45 ~ 100	50 ~ 150	50 ~ 200	50 ~ 250	50 ~ 350	50 ~ 500	70 ~ 700	100 ~ 1000	150 ~ 1500	250 ~ 2500	400 ~ 4000	
	Fuel Oil	Heavy oil Viscosity 700mm ² /s at 50°C , MGO, MDO and Waste oil											
	Fuel Oil Pressure (MPa)	0.15	0.3										
	Revolution (RPM)	6000					3000 ~ 6000			3000 ~ 6000			
	Rotary Cup Drive System	Motor					Direct Drive System					Motor Direct Drive System	
	Automatic Control System	ON/OFF Control		ON/OFF & HIGH/LOW Control			ON/OFF & Proportional Control						
	Ignition System	MGO/MDO Pilot Burner											
	Burner Motor	150W (DC24V)					250W (DC48V)			0.75kW × 2p	1.5kW × 2P	1.5kW × 2P	3.7kW × 2P
Main Accessories	Wind Box (Secondary Air Damper, Secondary Air Vane, Primary Oil Pressure Gauge, Junction					Air Duct, Peep Hole), Air Pressure Switch, Flame Eye, Pilot Burner for Ignition, Oil Control Valve, Control Motor and Linkage, Box, Oil Flow Regulating Valve and Oil Flow Meter (This is standard for above SDR-350)							
Primary Air Blower	Type	Turbo Blower											
	Air Volume (Nm ³ /min)	1	2.3	4	4	6	8	11	17	24	40	68	
	Air Pressure (kPa)	9.8					7.8					8.8	
	Motor (kW × P)	Common use with Secondary Air Fan					3.7 × 2P	3.7 × 2P	5.5 × 2P	7.5 × 2P	11 × 2P	18.5 × 2P	
Secondary Air Fan	Type	Turbo Fan and Blower (Primary & Secondary Air Fan motors are in					Common use)		Turbo Fan				
	Air Volume (Nm ³ /min)	24	34	50	60	85	120	160	185 ~ 220	260 ~ 355	400 ~ 645	645 ~ 970	
	Air Pressure (kPa)	1.96	2.45			3.43	2.94	2.45 ~ 3.43	2.94 ~ 3.92	3.14 ~ 4.9	4.4 ~ 6.0	5.4 ~ 7.4	
	Motor (kW × P)	3.7 × 2P	5.5 × 2P	7.5 × 2P	7.5 × 2P	15 × 2P	15 × 2P	15 × 2P ~ 18.5 × 2P	22 × 2P ~ 30 × 2P	30 × 2P ~ 55 × 4P	55 × 4P ~ 110 × 4P	110 × 4P ~ 175 × 4P	
Diesel Oil Pump for Ignition Burner	Type	Trochoid Gear Pump (MDO, MGO)											
	Capacity (kg/hr)	100					170						
	Pressure (Mpa)	0.7											
	Revolution (RPM)	3600											
	Motor (kW × P)	0.4 × 2P											
Heavy Oil Pump	Type	Trochoid Gear Pump (HFO, MDO, MGO)					Gear Pump (HFO, MDO, MGO)						
	Capacity (kg/hr)	600					1000	1400	3200		4800	8000	
	Pressure (Mpa)	0.5					0.5	0.5	0.6		0.6		
	Revolution (RPM)	1200					1200	1800	1200		1200		
	Motor (kW × P)	0.4 × 6P					0.75 × 6P	0.75 × 4P	2.2 × 6P		2.2 × 6P	3.7 × 6P	
Heavy Oil Heater	Type	Electric Heater					Steam Heater						
	Specification	Sheath Heater					Steam Coil						
	Heating Capacity	Inlet Temperature 60 deg C-Outlet					Temperature 130 deg C (70 deg C up) Heating capacity may be changed by oil specification						
	Electric Capacity (kWh)	3 ~ 12					—						
	Steam usage (kg/hr)	—					abt 26 ~ 250						
	Steam Pressure	—					Saturated Steam						
For Waste Oil Combustion Type (Option)	Combustion System	2 modes : FO & WO					3 modes : FO, WO & FO/WO mixing						
	Main Accessories	Pump, Electric Auto Cleaner, Press. Cont. Valve, FO/WO Change					Over 3way Valve (SDR-1 ~ 2.5), Oil Flow Meter (SDR-350 ~ 1500), Oil Regulating Valve (SDR-350 ~ 1500, R-9 ~ 40)						
	Pump Type	Trochoidal Gear					Pump 600kg/h × 0.5MPa 0.4kW × 6 P					1000kg/h × 0.75MPa 0.75kW × 6P	
Remarks	1. Standard Unit is One(1) Set. Due to ship class or capacity requirement, 2. Type of Rotary Cup Burner may be changed by necessary combustion					FO pump and FO Heater can be provided as extra unit. capacity, furnace pressure and fuel oil specification.							

Outline Drawing

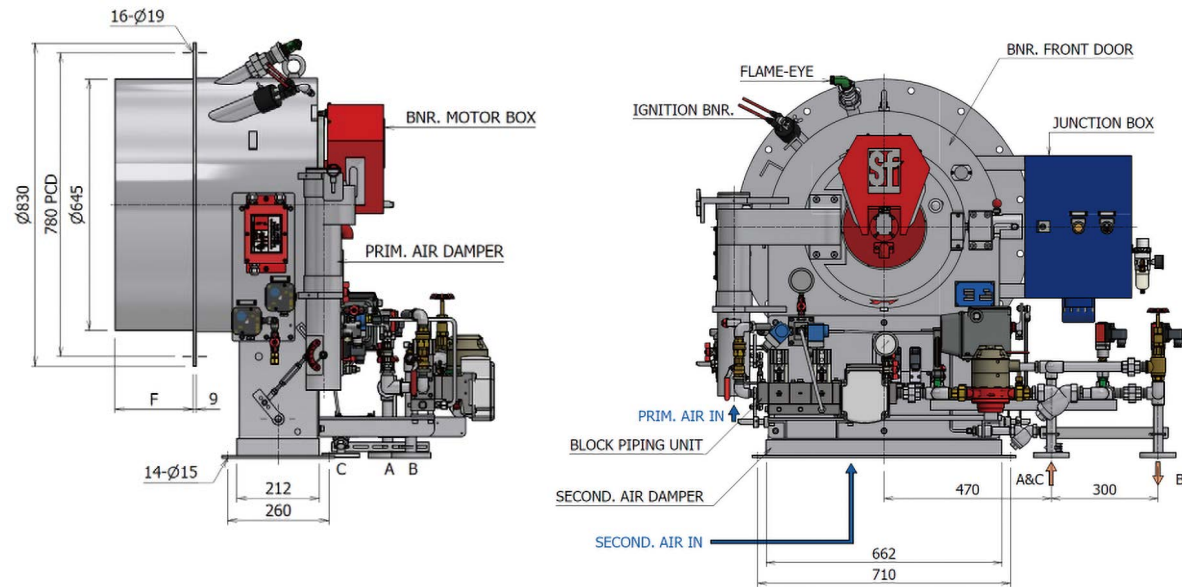
SDR-1 / 1.5 / 2 / 2.5



	D	E	F	G	H	I	J	Weight
SDR-1	120	333	133	120	164	200	234	240
SDR-1.5	130	440	165	130	184	200	234	240
SDR-2	160	440	165	200	236	250	286	240
SDR-2.5	160	475	175	200	236	270	306	240

A ... F.O. IN : JIS 10K 20A
 B ... F.O. RETURN : JIS 10K 20A
 C ... D.O. IN : JIS 10K 15A

SDR-350 / 500 / 700

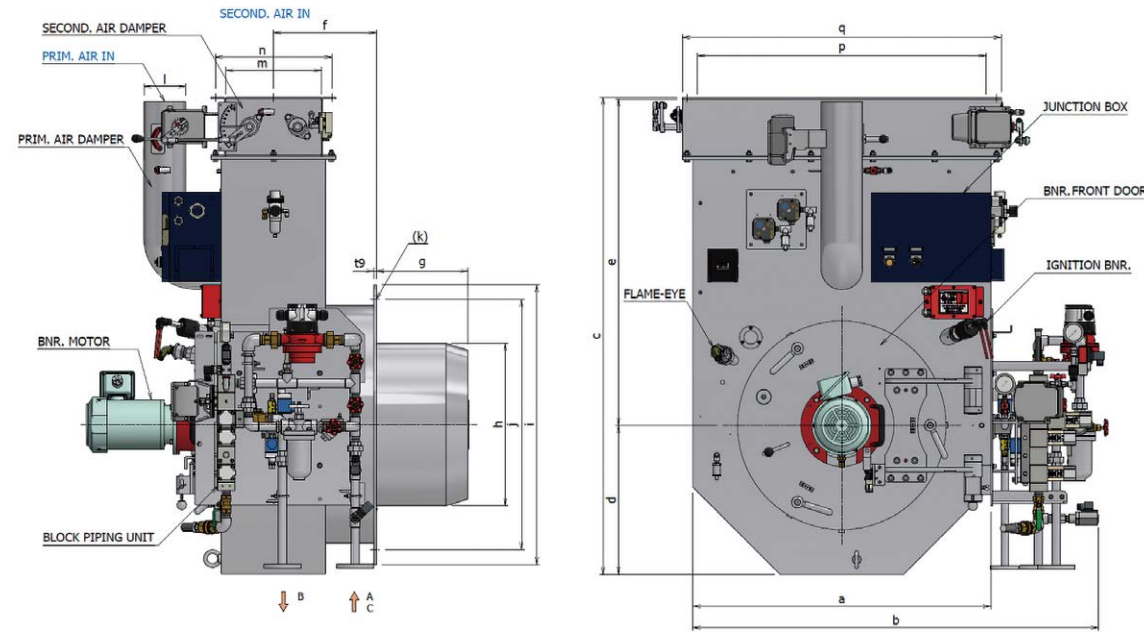


	F	Weight
SDR-350	200/250	370
SDR-500	200/250	370
SDR-700	200/250	370

A ... F.O. IN : JIS 10K 20A
 B ... F.O. RETURN : JIS 10K 20A
 C ... D.O. IN : JIS 10K 15A

Outline Drawing

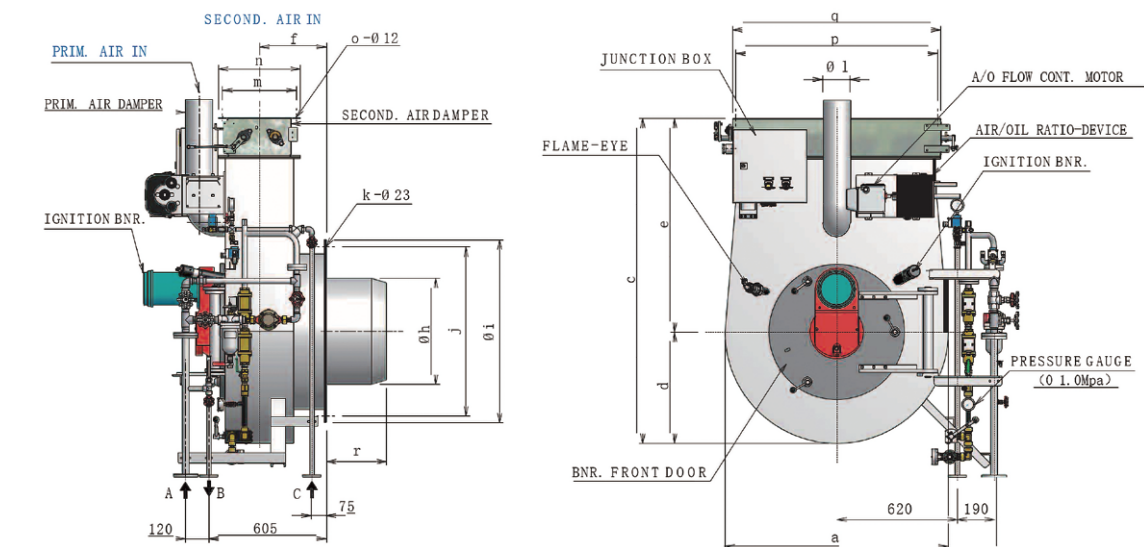
SDR-1000 / 1500



	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	Weight
SDR-1000	950	1290.5	1430	475.5	955	344	283	φ506	φ800	PCD730	12-φ23	φ114.3	344	390	12-φ12	744	790	550
SDR-1500	1000	1325.5	1600	500	1100	345	307	φ546	φ940	PCD870	12-φ23	φ139.8	320	390	14-φ12	970	1040	600

A ... F.O. IN : JIS 10K 25A
 B ... F.O. RETURN : JIS 10K 25A
 C ... D.O. IN : JIS 10K 15A

R-25 / 40



	a	c	d	e	f	h	i	j	k	l	m	n	o	p	q	r	Weight
R-25	1360	1900	680	1220	315	φ730	φ1100	PCD1030	12	φ159	498	530	18	1248	1280	350	850
R-40	1650	2065	825	1350	350	φ870	φ1240	PCD1170	16	φ193.7	549	580	20	1449	1480	350	1200

A ... F.O. IN : JIS 10K 25A (R-40 : 32A)
 B ... F.O. RETURN : JIS 10K 15A
 C ... D.O. IN : JIS 10K 15A