



GREEN
FUEL
CATALYST

Installation Manual

Fuel Catalyst FHD5HP to FHD100HP

For Marine Fuel Systems

Made in USA



Patented Fitch® fuel catalyst technology

Contents

1. INTRODUCTION	4
1.1 About.....	4
1.2 Intended Use.....	4
1.3 Approvals and Certification.....	4
1.4 Disposal	4
2. SAFETY	4
2.1 Fire Protection	4
2.2 Safety Equipment.....	4
2.3 Qualified Personnel.....	5
2.4 Warning	5
3. GENERAL EQUIPMENT INFORMATION.....	6
3.1 Housing Assembly Technical Specification for FHD5HP to FHD40HP Catalyst Models	6
3.2 Housing Assembly Technical Specification for FHD50HP to FHD100HP Catalyst Models	7
3.3 Technical Data for Catalyst Model FHD5HP to FHD100HP Core.....	8
3.4 Estimated Wet Weight for Catalyst Model FHD5HP to FHD100HP	8
4. INSTALLATION	9
4.1 Unpacking	9
4.2 Identification of the Catalyst Location.....	9
4.2.1 Access, Ventilation and Maintenance.....	9
4.2.2 Hot Surfaces	9
4.2.3 Arrangement of Fuel Oil Equipment and Piping	9
4.2.4 Leakage Containment and Drainage System:	9
4.2.5 Valve Operation.	10
4.2.6 Multi-pass Fuel Flow Through Catalyst.....	10
4.2.7 Clearance.....	10
4.2.8 Bypass Line.....	10
4.3 Installation	10
4.4 Other Information.....	10
4.5 Sample Installation Drawing with Bypass Line.....	11
5. Operation and Service	12
5.1 Core Cleaning Procedure	12
5.1.1 Shutdown Procedure	13

5.1.2 Catalyst Core Cleaning	13
5.1.3 Start-Up Procedure	13
5.2 Core Replacement Procedure	13
6. Routine Safety Checks	14
6.1 Daily Basis	14
6.2 Quarterly	14
6.3 Other	14
7. Appendix.....	15
7.1 Material Safety Data Sheet	15
• To be supplied with equipment	15
7.2 Core Cleaning Plan	16
7.3 Installation Check List	17
7.4 Symbols, Abbreviations, and Convention	18
7.5 FHD5HP to FHD40 HP Housing Assembly Drawing	19
• To be supplied with equipment	19
7.6 FHD50HP to FHD100HP Housing Assembly Drawing.....	20
• To be supplied with equipment	20
8. Important Notes	21

1.INTRODUCTION

1.1 About

Patented Fitch® catalyst technology consists of a Heterogeneous Metallic Alloy Composition (HMAC) which reduces activation energy of the chemical combustion reaction. Catalyst reverses the naturally occurring hydrocarbon fuel biodegradation (Oxidation-Reduction) process by inducing selective hydrogen abstraction and redistribution (Hydrogenation) that promotes selective Oxidation (formation of Alcohols, Aldehydes). Catalyst cracks the aromatic (less-reactive) compounds forming oxygen containing molecules with greater energy yield and higher combustibility.

1.2 Intended Use

Fuel catalyst is a permanent fuel treatment that reforms fuel (diesel, gasoline, or residual fuel oil), creating a more combustible, clean burning product. The Fuel Catalyst can be incorporated into an Existing Fuel System (Marine & Offshore). Catalyst provides at least 2% fuel consumption reduction along with improved fuel lubricity for various types of marine fuels, such as HFO, MDO, MGO etc.

Catalyst has no moving parts, no additives, no magnets, no electrical hook-ups, and does not require any special maintenance, lasting for 10,000 operating hours.

1.3 Approvals and Certification

Housing Assembly ABS Design Assessed.

1.4 Disposal

To see the catalyst chemical composition, please go to section 7.1 (Material safety data sheet). Collect it on board separately in accordance with currently valid MARPOL Annex V rules. Used catalyst core must be collected and handed over to the port reception facility.

2.SAFETY

Catalyst installation into marine fuel system is simple. All that is required, is to have a few hand tools and close following to the instruction manual guide. However, it is essential to do the installation carefully and safely. We recommend that you read the next few lines with the uttermost attention.

2.1 Fire Protection

Every installation must conform to local and/or provincial and/or international piping and fire codes.

2.2 Safety Equipment

During the installation make sure that involved personnel is properly protected, and is wearing PPE (personal protective equipment) such as, but not limited to, protective clothing, helmet, safety shoes, goggles, welding shield, safety gloves. Check your material safety data sheet for any instructions or suggestions.

2.3 Qualified Personnel

Catalyst may only be installed, commissioned, operated and maintained by properly trained and authorized personnel. This document is provided to help you establish operating conditions, which will permit safe and efficient use of this product.

2.4 Warning

Do not run catalyst in excess of the housing tank label. Do not open catalyst housing when system is under pressure; always relieve all pressure and use bypass piping before opening catalyst housing lid. Stop all flow through the catalyst by properly shutting off the on/off valves before opening the catalyst lid. The catalyst unit if under pressure may cause serious injury or death.

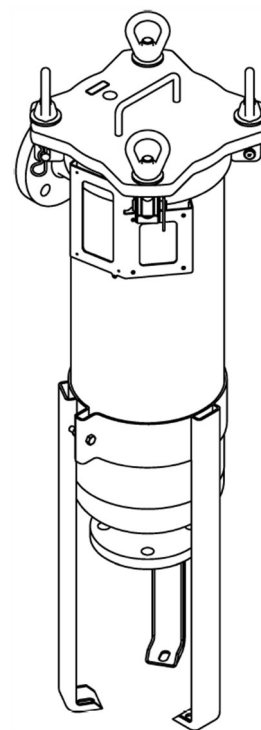
Ignoring safety rules may create a hazard to your health and to those around you!

3.GENERAL EQUIPMENT INFORMATION

Catalyst assembly is designed to meet the toughest hydrocarbon treatment conditions while providing maintenance personnel with an equipment that is easy to handle and maintain.

3.1 Housing Assembly Technical Specification for FHD5HP to FHD40HP Catalyst Models

- a) Vessel is in accordance with the ASME boiler and pressure vessel code, sect. VIII, Div. 1, latest ed. and is registered with national boards.
- b) Material: Shell; SA 414 GR. G, .099 nom. thk. Bottom head; SA 414 GR. G, .094 min. thk. Cover Plate; SA 516 GR. 70, .813 nom., .787 min. thk.
- c) MAWP: 300 PSI / 20 BAR. Hydro test at 390 PSI / 27 BAR
- d) Design temp.: -20° F / -28,9° C MIN. 500° F / 260° C MAX.
- e) See detailed "Bill of materials" for complete material specs.
- f) Unless otherwise noted, hold all threaded fittings to their centerline within 3/8" in 12".
- g) Vessel is to be clean, dry, and free of any weld slag, spatter, or foreign material inside and out.
- h) Finish:
 - i. No blast required.
 - ii. Wipe vessel down with acetone prior to powder coat.
 - iii. Mask off internal face of lid prior to powder coat.
 - iv. Powder coat leg assemblies and exterior of vessel only with RAL 9016, gloss white.
- i) Corrosion allowance = 0. No radiography.
- j) Vessel is exempt from impact testing per UG-20(f) and UCS-66.
- k) Nom. capacity: 6.39 gallons. (0.85 CU. FT.) / 24.2 liters. (0.024 CU.M.)
- l) Estimated dry weight: 75 LBS / 34.0 KG.
- m) Hardware is black zinc plated.
- n) Wrap pipe plugs with Teflon tape and place in a bag in vessel for shipment.
- o) Lightly coat the interior of the vessel with vegetable oil.
- p) All models of fabrication to be free of silicone.



3.2 Housing Assembly Technical Specification for FHD50HP to FHD100HP Catalyst Models

a) Vessel is in accordance with the ASME boiler and pressure vessel code, sect. VIII, Div. 1, latest ed. and is registered with national boards.

b) Material: Shell; SA 414 GR. G, .099 nom. thk. Bottom head; SA 414 GR. G, .094 min. thk. Cover Plate; SA 516 GR. 70, .813 nom., .787 min. thk.

c) MAWP: 300 PSI / 20 BAR. Hydro test at 390 PSI / 27 BAR

d) Design temp.: -20 °F / -28,9 °C MIN. 500 °F / 260 °C MAX.

e) See detailed "Bill of materials" for complete material specs.

f) Unless otherwise noted, hold all threaded fittings to their centerline within 3/8" in 12".

g) Vessel is to be clean, dry, and free of any weld slag, spatter, or foreign material inside and out.

h) Finish:

i. No blast required.

ii. Wipe vessel down with acetone prior to painting.

iii. Mask off internal face of lid prior to painting.

iv. Powder coat leg assemblies and exterior of vessel only with RAL 9016, gloss white.

i) Corrosion allowance = 0. No radiography.

j) Vessel is exempt from impact testing per UG-20(f) and UCS-66.

k) Nom. capacity: 9.19 gallons. (1.23 CU. FT.) / 34.8 liters. (0.035 CU.M.)

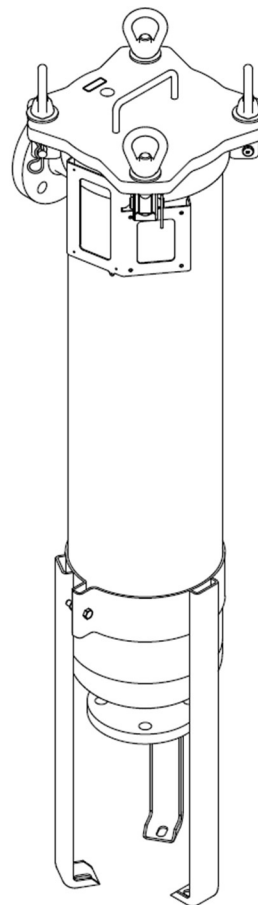
l) Estimated dry weight: 95 LBS / 43.1 KG.

m) Hardware is black zinc plated.

n) Wrap pipe plugs with Teflon tape and place in a bag in vessel for shipment.

o) Lightly coat the interior of the vessel with vegetable oil.

p) All models of fabrication to be free of silicone.



3.3 Technical Data for Catalyst Model FHD5HP to FHD100HP Core

Catalyst model	Catalyst max. fuel treatment rate (LPM)		Core height	
	MGO	HFO	Inches	cm
FHD5	19	13	2.6	6.6
FHD10	38	26	3.9	9.9
FHD15	57	40	5.3	13.5
FHD20	76	53	6.6	16.8
FHD25	95	66	8.0	20.3
FHD30	114	79	9.4	23.9
FHD40	151	106	12.1	30.7
FHD50	189	132	15.2	38.6
FHD60	227	159	18.4	46.7
FHD70	265	185	21.1	53.6
FHD80	303	212	23.9	60.7
FHD90	341	238	27.0	68.6
FHD100	379	265	30.1	76.5

3.4 Estimated Wet Weight for Catalyst Model FHD5HP to FHD100HP

Catalyst model	LBS	KG
FHD5	101	50.5
FHD10	107	53.4
FHD15	122	56.2
FHD20	118	59.1
FHD25	124	61.9
FHD30	130	64.8
FHD40	141	70.5
FHD50	221	110.7
FHD60	235	117.5
FHD70	246	123.2
FHD80	258	129.1
FHD90	271	135.7
FHD100	285	142.3

Note:

Estimated wet weight may vary, due to different fuel physical characteristics. Also, the amount of catalyst elements inside the core may slightly vary.

4.INSTALLATION

4.1 Unpacking

Unpack the fuel catalyst and discard any shipping materials.

4.2 Identification of the Catalyst Location

Fuel catalyst is to be installed in accordance with the requirements of the specific class Marine Vessel Rules.

4.2.1 Access, Ventilation and Maintenance

All spaces where fuel catalyst is to be located are to be easily accessible. Such spaces are to be sufficiently ventilated to prevent accumulation of oil vapor. As far as practicable, materials of either combustible or oil-absorbing properties are not to be used in such spaces.

4.2.2 Hot Surfaces

To prevent the ignition of fuel oil, all hot surfaces, e.g. steam and exhaust piping, turbochargers, exhaust gas boilers, etc. likely to reach a temperature above 220°C (428°F) during service are to be insulated with non-combustible, and preferably non-oil-absorbent, materials. Such insulation materials, if not impervious to oil, are to be encased in oil-tight steel sheathing or equivalent. The insulation assembly is to be well installed and supported having regard to its possible deterioration due to vibration.

4.2.3 Arrangement of Fuel Oil Equipment and Piping

As far as practicable, fuel catalysts are to be located far from sources of ignition, such as hot surfaces and electrical equipment. In particular, they are not to be located immediately above nor near such ignition sources. The number of pipe joints is to be kept to the minimum. Spray shields are to be fitted around flanged joints, flanged bonnets and any other flanged or threaded connections in fuel oil piping systems under pressure exceeding 1.8 bar (1.84 kgf/cm² , 26 psi) which are located above or near units of high temperature, including boilers, steam pipes, exhaust manifolds, silencers or other equipment required to be insulated in accordance with 4.2.2, and also to avoid oil spray or oil leakage into machinery air intakes or other sources of ignition.

4.2.4 Leakage Containment and Drainage System:

4.2.4.1 Leakage containment. Fuel oil system components, such as fuel catalysts, which require occasional dismantling for examination, and where leakage may normally be expected, are to have drip pans fitted underneath to contain the leakage. In way of valves fitted near the bottom of fuel oil tanks located above the double bottom and in way of other tank fittings, where leakage may be expected, drip pans are also to be provided. Free standing fuel oil tanks are to be provided with oil tight spill trays as in Marine Vessel Rules provided by specific classification society.

4.2.4.2 Drainage. Drip pans, spill trays and other leakage containment facilities are to be provided with a means of drainage. Where they are led to a drain tank, protection against back flows and venting through the drain lines are to be provided as follows:

- a) The drain tank is not to form part of the fuel oil overflow system.
- b) The drain tank is to be fitted with a high-level alarm for propulsion machinery spaces intended for centralized operation (ACC notation) or unattended operation (ACCU or ABCU notation).

c) Where drain lines entering the tank are not fitted with non-return valves, they are to be led to the bottom of the tank to minimize venting of the tank through the drain lines. This is not applicable to fuel oil drain tanks with a volume less than 2 m³ (70.6 ft³) and which cannot be filled up by a pump. Regarding termination of air vents, see specific rules of your classification society.

d) Where the drain tank is a double bottom tank, all drain lines entering the tank are to be fitted with non-return valves at the tank so as to protect the engine room from flooding in case of bottom damage to the tank.

e) The drain tank is to be fitted with a pumping arrangement to enable transfer of its content to shore facility or to other waste oil tanks.

4.2.5 Valve Operation.

Valves related to fuel oil systems are to be installed in readily operable and accessible positions.

4.2.6 Multi-pass Fuel Flow Through Catalyst

Fuel Catalyst location in the fuel supply line should be after fuel service tanks following the fuel filters and heaters. **Typically, this may mean installation of the catalyst after the booster pumps to ensure multi-pass fuel flow through catalyst.**

4.2.7 Clearance

Provide room for the housing to clear the cartridge during change-out. Minimum 50 cm base clearance is required.

4.2.8 Bypass Line

Always install the catalyst unit with bypass valves to allow for smooth cleaning or exchange and maintenance procedures. **Ensure that a fuel filter is always placed before the catalyst unit. Be sure to correctly identify the inlet and outlet connections to avoid piping the unit backwards. The unit will not perform properly if connections are reversed.**

4.3 Installation

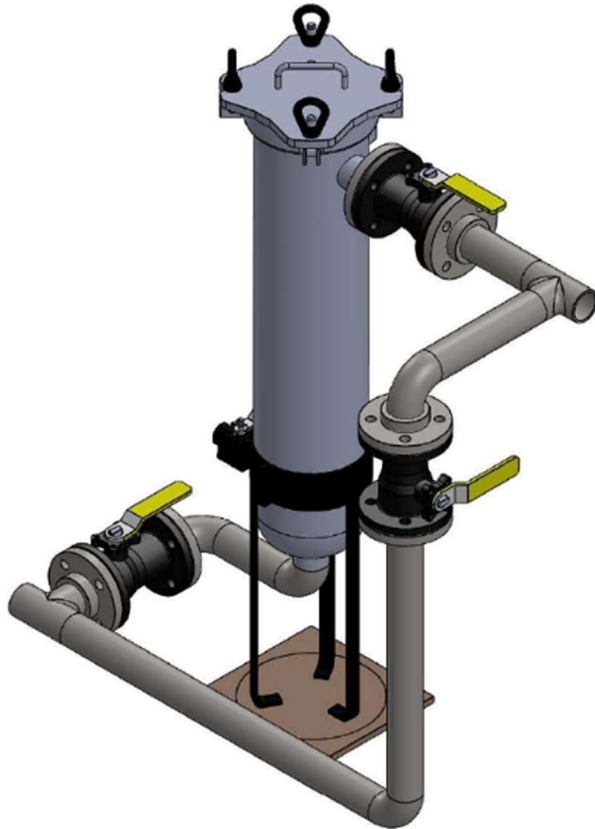
- a. Remove the housing protectors from the inlet and outlet connections. Make certain that connections are free of any debris.
- b. Place fuel catalyst in the desired location on a flat surface.
- c. Secure support legs to the base.
- d. Provide shut-off valves in the inlet and outlet piping as close to the unit as possible for isolating the unit from the system when cartridge replacement is necessary.
- e. Tighten housing with proper tension to seal housing on existing pipe or flange. Note: housing has been factory pressure tested to assure a leak proof vessel. If leaking occurs, check for improper connections.
- f. Provide room for the housing to clear the cartridge during change-out. Minimum 50 cm base clearance required.

4.4 Other Information

Fuel catalysts are designed to withstand the maximum working pressure of the system in which they are installed. Fuel catalysts must be installed with a bypass line to enable cleaning without disrupting the oil supply. For cleaning during operation, fuel catalysts are fitted with means of depressurizing before being opened and venting before being put into operation. For this purpose, valves and cocks for drainage and

venting are provided. Drain pipes and vent pipes are to be led to a safe location. For leakage containment and drainage, see 4.2.4.

4.5 Sample Installation Drawing with Bypass Line



5. Operation and Service

It is recommended that the vent and drain valves be opened on a scheduled basis to permit the escape of entrapped air and accumulated water.

Since there are no moving parts, maintenance is limited to an occasional rinsing of the catalyst core using light fuel oil or detergent. This should be done in accordance with filter changes especially in heavy fuel oil.

The head gasket should be carefully inspected for signs of damage or deterioration each time the housing is opened. We recommend the gasket to be lubricated with petroleum jelly prior to installation.

Catalyst unit has no moving parts, no additives, no magnets, no electrical hook-ups, and is also maintenance free whenever used in applications for light fuel oil.

NOTE:

Whenever there is an application for HFO or any other similar fuel type, please follow the catalyst core cleaning instructions as per sections 5.1 'Core Cleaning Procedures', and 7.2 'Core Cleaning Plan'.

5.1 Core Cleaning Procedure

Catalyst unit must be cleaned when used with HFO every 1,000 operating hours or 3 months whichever comes first to maximize the catalyst lifetime.

WARNING! Operator should wear protective clothing including protective gloves and face shield when servicing the catalyst housing.

WARNING! Do not service catalyst housing when either the inlet or outlet valves are open or while unit is still under pressure.

WARNING! Do not loosen closure swing bolts before draining. Failure to open the drain and properly vent the housing will result in pressurized liquid being trapped in housing. Pressurized liquid will spray out when the bolts are loosened which could cause serious injury and/or property damage.

WARNING! Do not operate the housing with damaged or worn parts. Serious injury and/or damage can occur. Inspect housing interior and all components for wear, corrosion or damage.

WARNING! Do not exceed operation limits that are listed in the housing label. Property damage, serious injury or death can result if limits are exceeded.

It is recommended that the vent and drain valves be opened on a scheduled basis to permit the escape of entrapped air and accumulated water.

Since there are no moving parts, maintenance is limited to an occasional rinsing of the cartridge using light fuel oil or detergent. This should be done in accordance with filter changes especially in heavy fuel oil applications.

5.1.1 Shutdown Procedure

- a) Turn on bypass to take the unit out of the supply loop prior to opening catalyst housing.
- b) Close inlet and outlet valves. Inlet or pressure side should always be closed first.
- c) Open and leave open vent valve to reduce internal pressure to zero. Make sure the valve is piped such that escaping fluids do not cause personal injury and/or property damage.
- d) Open bottom drain. If proper venting has been provided, gravity will move fluid through the drain. After housing has drained, close drain valve.
- e) Loosen all cover swing bolts and remove from cover. Check for wear and/or damage.
- f) Swing open hinged cover lid to fully open position from housing body.

5.1.2 Catalyst Core Cleaning

- a) Follow the shutdown procedure (See section 5.1.1)
- b) Remove the catalyst core by grasping the handle and pulling upwards.
- c) Inspect O-ring for wear and replace if necessary, to ensure a good seal to reduce by-pass.
- d) Clean the insert in light oil or kerosene
- e) Insert the cleaned catalyst core back in to the housing.

5.1.3 Start-Up Procedure

- a) Clean and inspect closure O-ring and O-ring groove. Lubricate O-ring heavily with suitable lubricant for O-ring material and media.
- b) Close cover lid by swinging back centered over housing body.
- c) Rotate swing bolts upward and hand tighten on cover.
- d) Gradually tighten the eye nuts in an alternating crisscross pattern to a final torque value of 100 ft.-lbs. Do not apply excessive torque to the swing bolts as permanent damage to the housing or bolting hardware may result.
- e) Close the housing drain and open the system vent, if provided.
- f) Check inlet valve and make sure it is still open, and fill housing slowly. Don't allow fluid to spray from the vent!
- g) When all air is expelled from the vent and liquid begins to bleed from the vent, close the system vent.
- h) Open the bypass valves to resume normal operation.

5.2 Core Replacement Procedure

Fuel catalyst core lifetime is 10,000 operating hours. After 10,000 operating hours it is recommend to check the efficiency of the catalyst. If the efficiency of the catalyst is low it is recommended to change the catalyst core. To order new core please contact you local GFC distributor. Once you have received the new catalyst core, please follow the next few lines in order to successfully change the catalyst core.

- a) Follow the shutdown procedure (See section 5.1.1)
- b) Remove the used catalyst core by grasping the handle and pulling upwards.
- c) Inspect O-ring for wear and replace if necessary, to ensure a good seal to reduce by-pass.
- d) Place the new catalyst core inside the catalyst housing
- e) Follow the Start-Up Procedure (See section 5.1.3)

6. Routine Safety Checks

6.1 Daily Basis

Catalyst shall be visually checked daily, and any irregularities or deficiencies shall be followed-up and be reported to the responsible engineer.

The checks shall be performed visually with due consideration of the following indicators:

- ✓ Leakages
- ✓ Other observations applicable

6.2 Quarterly

Catalyst shall be visually checked quarterly, and any irregularities or deficiencies shall be followed-up and be reported to the responsible engineer.

The checks shall be performed visually, and if applicable also mechanically with due consideration of the following indicators:

- ✓ Leakages
- ✓ Core cleaning plan
- ✓ Fittings
- ✓ Bolts
- ✓ Valves
- ✓ Gaskets
- ✓ Housing
- ✓ Other as applicable

6.3 Other

It is recommended to check the catalyst for any irregularities or deficiencies 30 minutes after the main engine has been started.

7. Appendix

7.1 Material Safety Data Sheet

- To be supplied with equipment

7.2 Core Cleaning Plan

Please use provided core cleaning plan as outlined below in order to control catalyst core cleaning schedule.

Activity	Catalyst model	Engine operating hour figures	Date	Initials of responsible person	Signature
<i>Installation</i>					
Core cleaning					
Core cleaning					
Core cleaning					
Core cleaning					
Core cleaning					
Core cleaning					
Core cleaning					
Core cleaning					
Core cleaning					
Core cleaning					
Core cleaning					
Core cleaning					

Core cleaning must be done accordingly to core cleaning procedures. See section 5.1 of the installation manual!

7.3 Installation Check List

Before completing installation of the unit, inspect the entire installation area. Check and mark the items when completed.

Nr.	Description	<input checked="" type="checkbox"/>
1	Check for properly secured catalyst housing to the floor/wall	
2	Check for properly secured Inlet and outlet connections	
3	Check for properly installed bypass valves	
4	Check ventilation and drain valves (both must be closed)	
5	Check for broken or damaged piping, if found, repair or replace immediately	
6	Check if catalyst drip pan is properly installed. See section 4.2.4	
7	Check if catalyst core is properly inserted in to the housing	
8	Check if catalyst housing head is properly closed	

Responsible person: _____
(Name and Signature)

(Date)

7.4 Symbols, Abbreviations, and Convention

°C	Degrees Celsius
°F	Degrees Fahrenheit
ABCU	Automatic Bridge Centralized Control Unmanned
ACC	Automatic Centralized Control
ACCU	Automatic Centralized Control Unmanned
ASME	American Society of Mechanical Engineers
CU.	Cubic
FT.	Feet
GFC	Green Fuel Catalyst
HFO	Heavy Fuel Oil
HMAC	Heterogeneous Metallic Alloy Composition
kgf	kilogram-force
LBS	Pound
LPM	Liters Per Minute
M.	meter
MARPOL	International Convention for the Prevention of Pollution from Ships
MAWP	Maximum allowable working pressure
MAX.	Maximum
MDO	Marine Diesel Oil
MGO	Marine Gasoil
MIN.	Minimum
MSDS	Material Safety Data Sheet
nom.	nominal
PSI	Pound per Square Inch
Temp.	Temperature
thk.	thickness

7.5 FHD5HP to FHD40 HP Housing Assembly Drawing

- To be supplied with equipment

7.6 FHD50HP to FHD100HP Housing Assembly Drawing

- To be supplied with equipment

8.Important Notes

For any questions, please contact your local distributor.

Any variations from these instructions should also be pre-approved by manufacturer.

www.greenfuelcatalyst.com

info@greenfuelcatalyst.com

Copyright © 2020 Green Fuel Catalyst Inducont Ltd. All rights reserved