

CCG "Hero Class"  
**New Main Engine Exhaust Outlets**

For

Canadian Coast Guard / Dept. of Fisheries & Oceans



*Prepared By:*  
***Lengkeek Vessel Engineering Inc.***

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*Prepared By: D.O'Rourke*

*Checked By: D.Careless*

*LVE Form 67, rev1*

## Revision Matrix

<i>Rev</i>	<i>Brief description of revisions made</i>	<i>Issued to client</i>

## TABLE OF CONTENTS

<b>1</b>	<b>GENERAL.....</b>	<b>2</b>
<b>2</b>	<b>PRINCIPAL PARTICULARS, CCG HERO CLASS VESSELS.....</b>	<b>2</b>
<b>3</b>	<b>REMOVALS .....</b>	<b>2</b>
3.1	EXISTING TRANSOM PENETRATION AND EXHAUST PIPING.....	2
3.2	TRANSOM PLATING AND PENETRATION SUPPORT BRACKETS.....	2
<b>4</b>	<b>NEW TRANSOM PENETRATION AND EXHAUST PIPING .....</b>	<b>3</b>
4.1	TRANSOM EXHAUST PENETRATION, MATERIAL AND WELDING .....	3
4.2	EXHAUST PIPING AND SEA WATER INJECTION.....	4

## APPENDIX A: MAIN ENGINE EXHAUST STRIP-OUT AND REMOVAL

## APPENDIX B: NEW MAIN ENGINE EXHAUST OUTLETS

## 1 GENERAL

Lengkeek Vessel Engineering Incorporated (LVE) have been tasked with the re-design of the main engine exhaust outlets to replace those presently fitted which have experienced significant corrosion in the area of the transom. The existing transom penetrations are based on the original Damen design, however, it is suspected that a reduction in the length of the stainless steel portion of the connecting piece combined with the corrosive nature of the exhaust/sea water mixture exiting the transom at this location has been the cause of significant corrosion of the welded-in steel penetration piece and the surrounding weld area

During the design process, different options have been considered for the replacement of the existing transom penetration piece. All options considered involved the use of either stainless steel or duplex stainless steel throughout the penetration piece with a goal of having the exhaust/sea water mixture exiting away from the hull and surrounding steel plating as much as possible. Temperature readings i.w.o. the existing exhaust penetrations were taken on two of the Hero Class vessels to determine the maximum temperature experienced at this location during normal operation of the vessel. Although very close to the maximum allowable operating temperatures for long-term service when using Duplex S.S., some temperature readings were in excess of the upper limit for Duplex S.S. To avoid the possibility of precipitation and subsequent embrittlement and reduction of corrosion resistance of the Duplex S.S. from over-temperatures, it has been decided 316L stainless steel will be the material of choice for the new exhaust penetrations.

## 2 PRINCIPAL PARTICULARS, CCG HERO CLASS VESSELS

Length	42.8 m
Beam Moulded	7.0 m
Draft	2.8 m
Depth at CL	3.91m

## 3 REMOVALS

### 3.1 EXISTING TRANSOM PENETRATION AND EXHAUST PIPING

The existing hull penetration and flanged connecting piece are to be removed in their entirety. The portion of piping between the connecting flange and the first set of pipe flanges on the horizontal exhaust run (which contains the flanged connection for the sea water injection) is to be removed as well.

The existing sea water injection line with flanged connection to the exhaust pipe is to be removed and re-used in the new exhaust pipe section which will be installed at this location. See drawing J15073-S01 for further guidance on removals.

### 3.2 TRANSOM PLATING AND PENETRATION SUPPORT BRACKETS

The corroded weld area surrounding the existing hull penetration piece and any corroded transom plating outside of this weld area is to be cut-out. Care is to be taken to ensure no additional plating that remains in good condition, is cut away in the process. If the corroded area of transom plating exceeds the area of new penetration plating, then insert plates of the original

thickness and grade are to be installed, in accordance with Lloyd's Register (this will vary by ship and by P&S side of each ship).

The existing inboard support brackets for the hull penetration piece are to be cut back and removed.

## **4 NEW TRANSOM PENETRATION AND EXHAUST PIPING**

### **4.1 TRANSOM EXHAUST PENETRATION, MATERIAL AND WELDING**

Details of the new exhaust penetration arrangement can be seen on Dwg. J15073-M01.

New transom penetrations (2 off) will be constructed entirely using 316L stainless steel and will be welded directly into the transom plating. No Carbon Steel will be used in the penetration piece as this appears to be the main issue with the existing installation. The combination of hot exhaust gas and sea water at the outlet has heavily corroded the existing penetration piece at the transom plating.

316L S.S. is readily weldable using a higher alloy, extra low carbon content filler.

For Carbon Steel (CS) to 316L SS dissimilar weld connections, the following procedures are to be followed:

- a. Higher alloy, extra low carbon weld filler required (e.g. 309MoL).
- b. Low heat input weld process/procedure should be used (e.g. GMAW-P process with 99.99% Ar shielding gas), with a maximum heat input not to exceed 1.5 KJ/mm and a maximum interpass temp. not to exceed 150 C.
- c. No preheat required above 10 C min. ambient temp. and no post weld heat treatment required.
- d. Dissimilar metal weld joint to be designed to provide a gradual, smooth transition from the thicker 316L to the thinner CS transom plating, e.g. chamfer one side with a 1:4 minimum slope and with the opposite side flush. Side 2 to be back ground to sound metal on completion of welding Side 1 and prior to welding Side 2.  
Note : if no chamfer is used, then additional weld (fillet reinforcement) should be required to provide the specified smooth, gradual transition, ensuring acceptable weld profiles, free of notches/stress concentrations.
- e. Appropriate weld sequencing to minimize distortion, (e.g. welding alternately or simultaneously at diametrically opposite segments/quadrants).
- f. Weld procedure to be qualified simulating the production weld joint, following the qualification guidelines of ASME IX.

New support brackets for the penetration piece, similar to those in place now, are to be installed and proper welding procedures as discussed above, are to be followed. In addition, the cap of the insert/transom plate weld is to be ground flush before welding of the support brackets.

All areas where welding of dissimilar metals has occurred are to be ground smooth and coated with suitable heat resistant epoxy before painting to prevent exposure of the dissimilar weld

area to the sea water environment. This coating system is to be inspected and maintained on a regular basis.

#### **4.2 EXHAUST PIPING AND SEA WATER INJECTION**

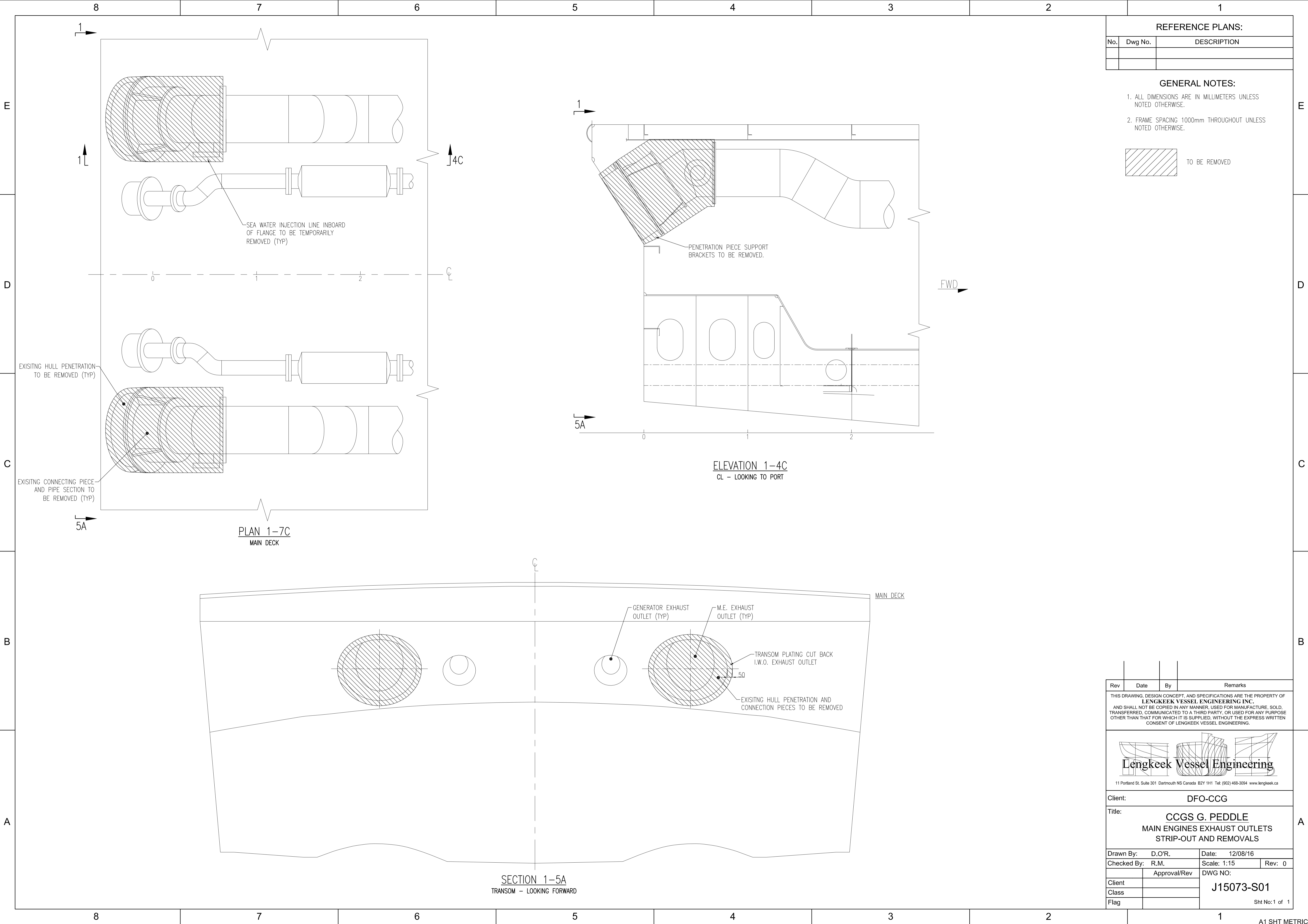
A new exhaust pipe section will be installed to connect the new transom penetration piece with the existing exhaust piping forward of the removal section. The new exhaust pipe will incorporate a flanged sea water connection identical to the one presently fitted and will connect with the existing sea water piping at that location.

The existing sea water injection pipe section presently flange connected to the exhaust pipe is to be removed from the old exhaust pipe section and reinstalled with the new exhaust piping in the same manner. If the existing sea water injection nozzle does not locate to the centre of the exhaust pipe when re-installed, it is to be modified to suit.

Material separation is to be maintained between dissimilar metals.

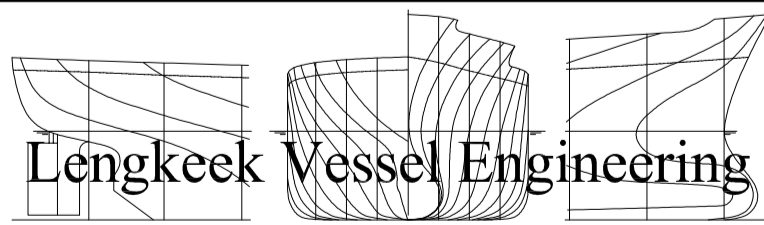
See drawing J15073-M01 for further guidance on the installation.

## **APPENDIX A: MAIN ENGINE EXHAUST STRIP-OUT AND REMOVAL**

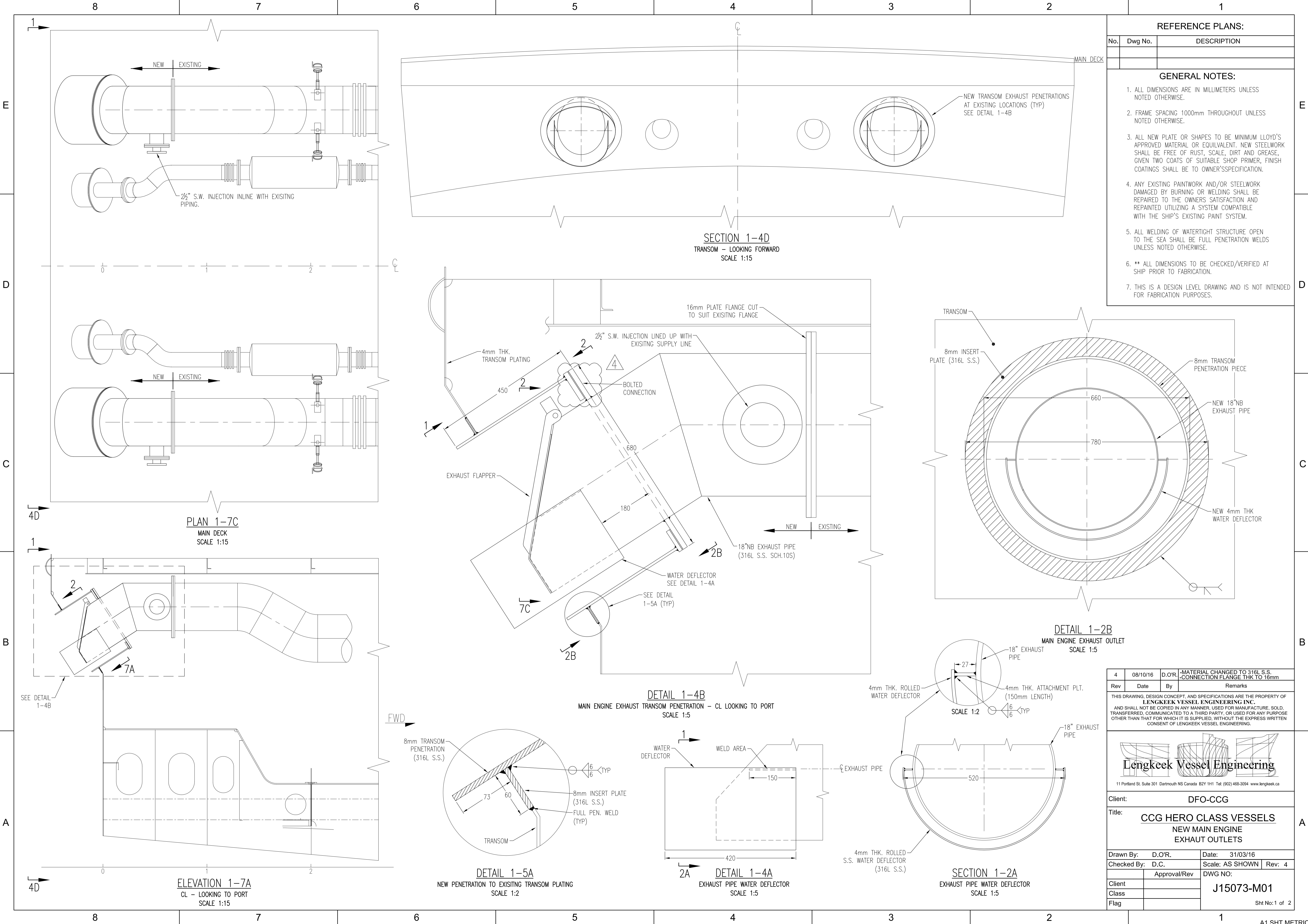


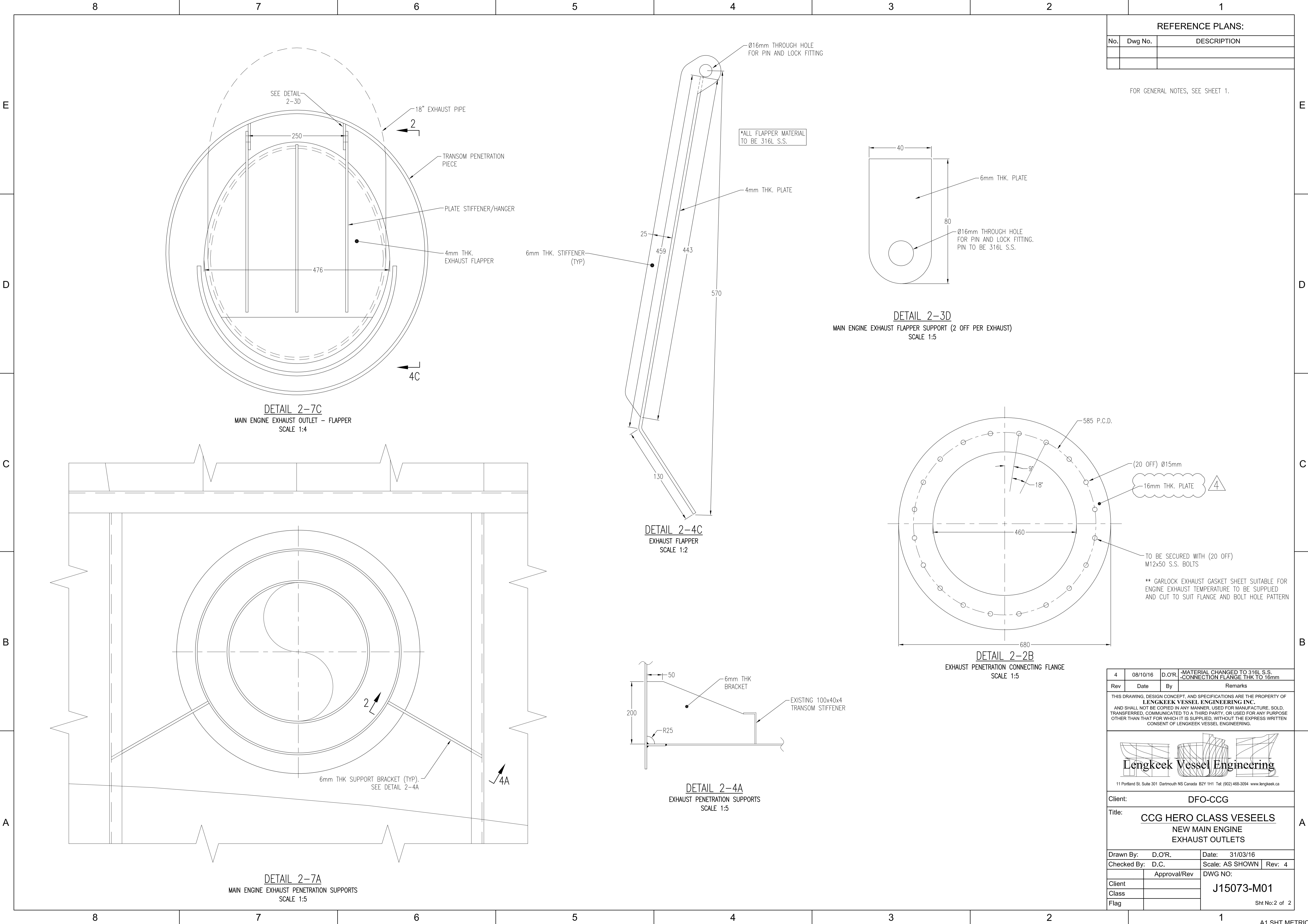
REFERENCE PLANS:		
No.	Dwg No.	DESCRIPTION

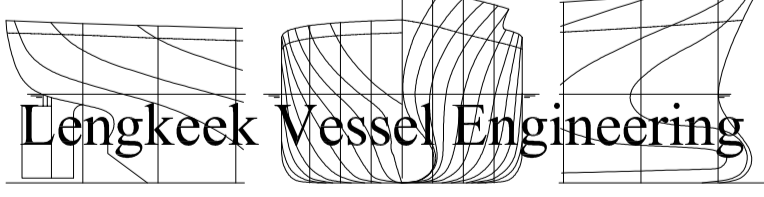
GENERAL NOTES:		
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.		
2. FRAME SPACING 1000mm THROUGHOUT UNLESS NOTED OTHERWISE.		
<div>TO BE REMOVED</div>		

Rev	Date	By	Remarks
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Client: <b>DFO-CCG</b>			
Title: <b>CCGS G. PEDDLE MAIN ENGINES EXHAUST OUTLETS STRIP-OUT AND REMOVALS</b>			
Drawn By: <b>D.O'R.</b>		Date: <b>12/08/16</b>	
Checked By: <b>R.M.</b>		Scale: <b>1:15</b>	Rev: <b>0</b>
Approval/Rev		DWG NO:	
Client		<b>J15073-S01</b>	
Class			
Flag			
		Sht No: 1 of 1	

## **APPENDIX B: NEW MAIN ENGINE EXHAUST OUTLETS**





4	08/10/16	D.O'R.	-MATERIAL CHANGED TO 316L S.S. -CONNECTION FLANGE THK TO 16mm	
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Client:		DFO-CCG		
Title:		<u>CCG HERO CLASS VESEELS</u> <u>NEW MAIN ENGINE</u> <u>EXHAUST OUTLETS</u>		
Drawn By: D.O'R.		Date: 31/03/16		
Checked By: D.C.		Scale: AS SHOWN		Rev: 4
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				Sht No:2 of 2