

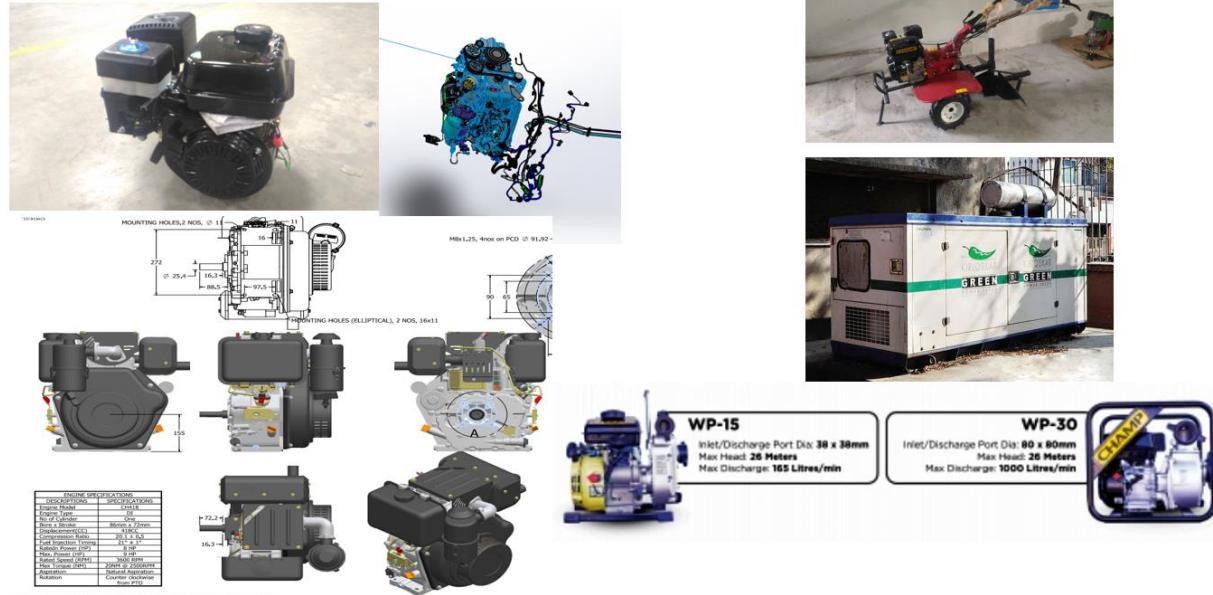
Mangirish Kulkarni-

Note- Please do not share-

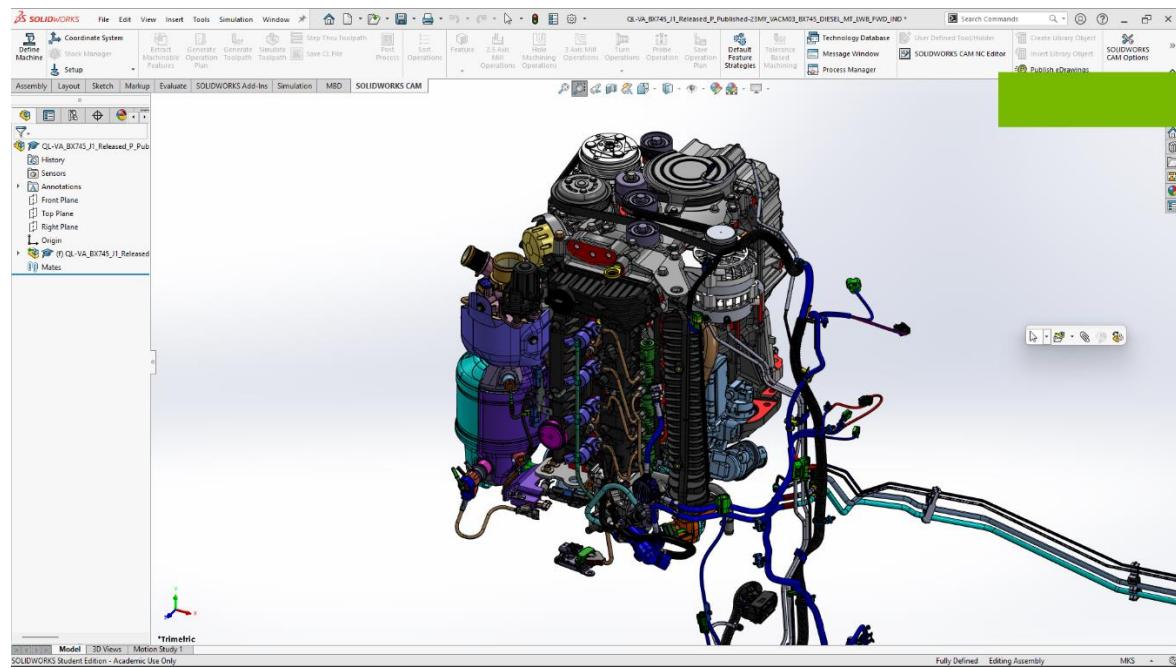
Products worked on-

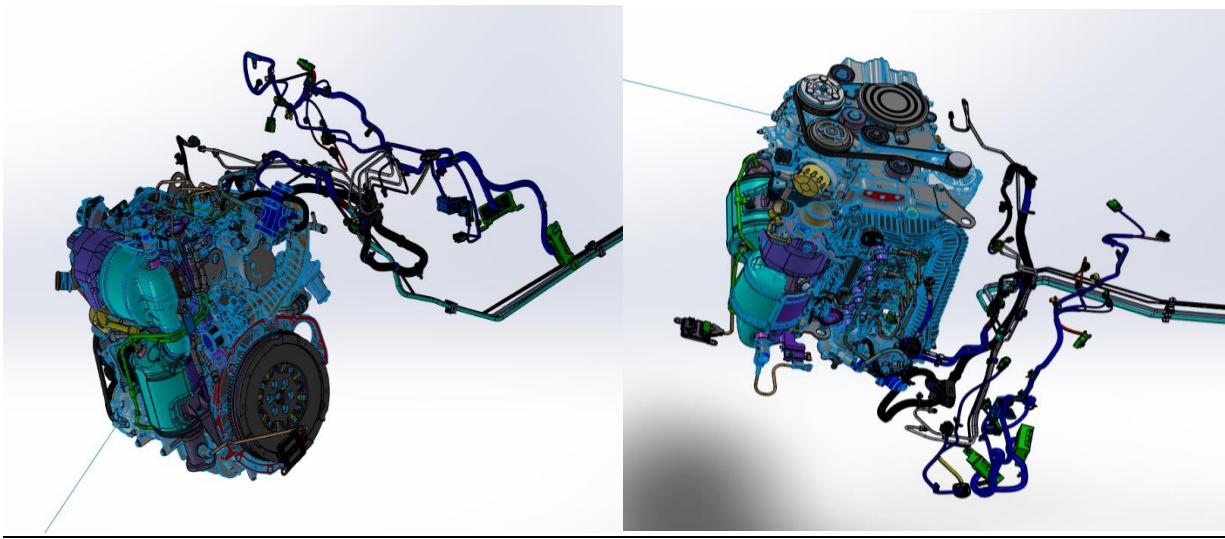
Engines- Kirloskar oil engines-CH 196, 418, 760. Mahindra- MAH 1400

PRODUCTS-

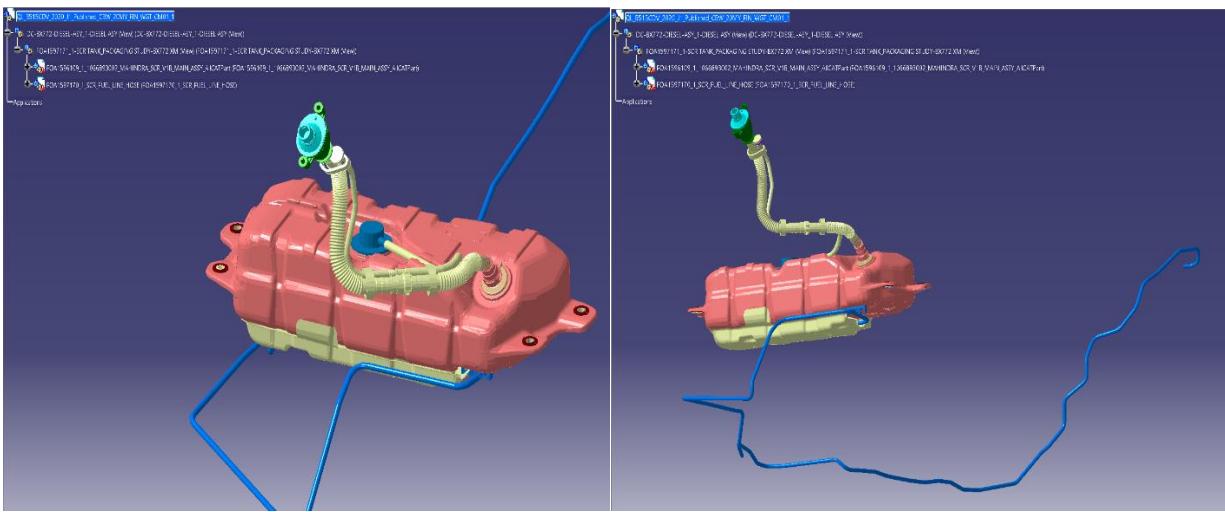


Mahindra- MAH 1400-

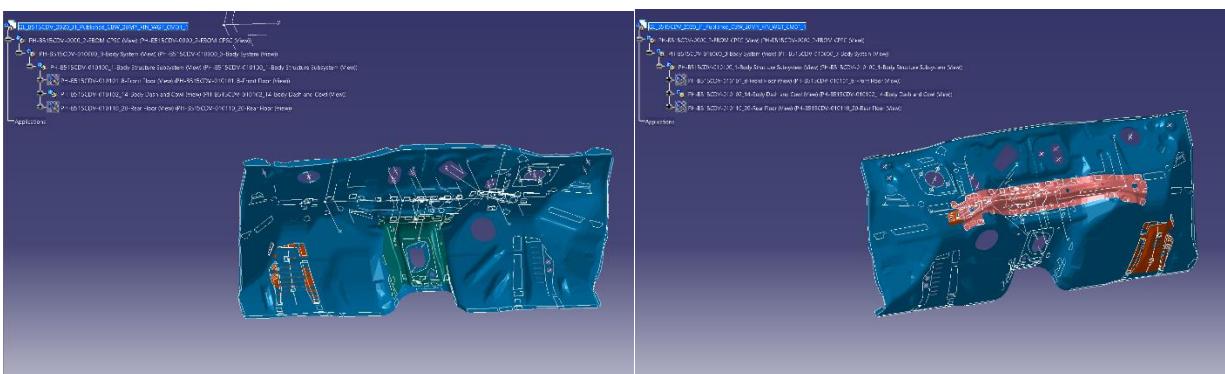




MAH 1400 Tank design-

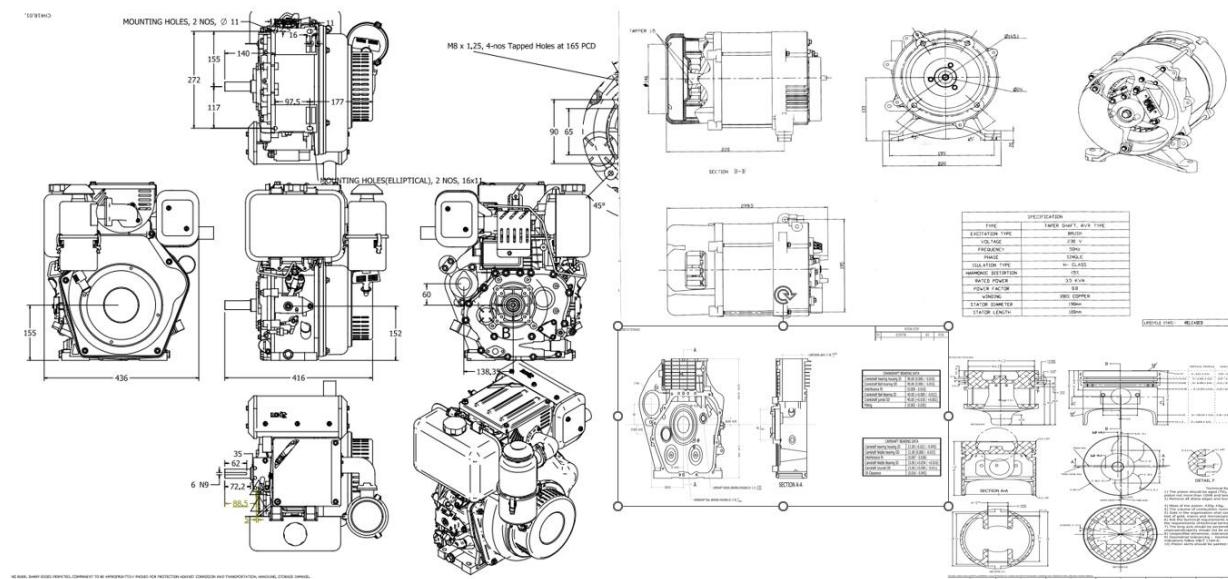


Firewall Mounting BIW design-



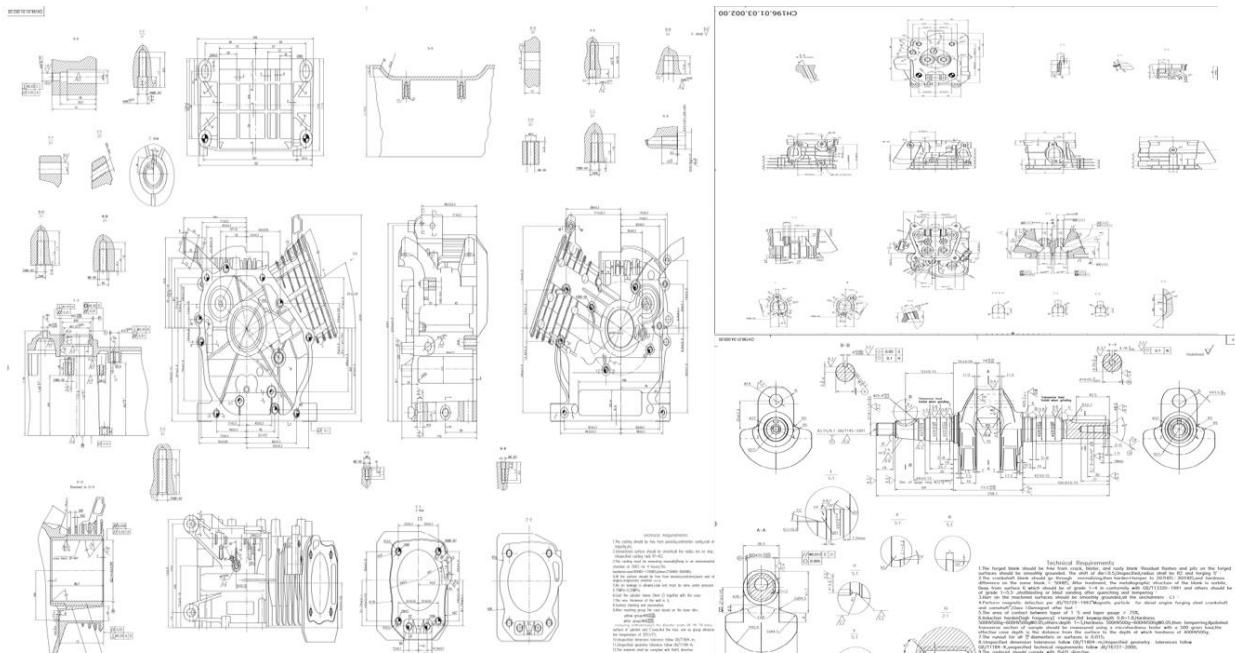
Engine and Alternator Assemble of KOEL 55 Kva genset-

CC- 55 KVA

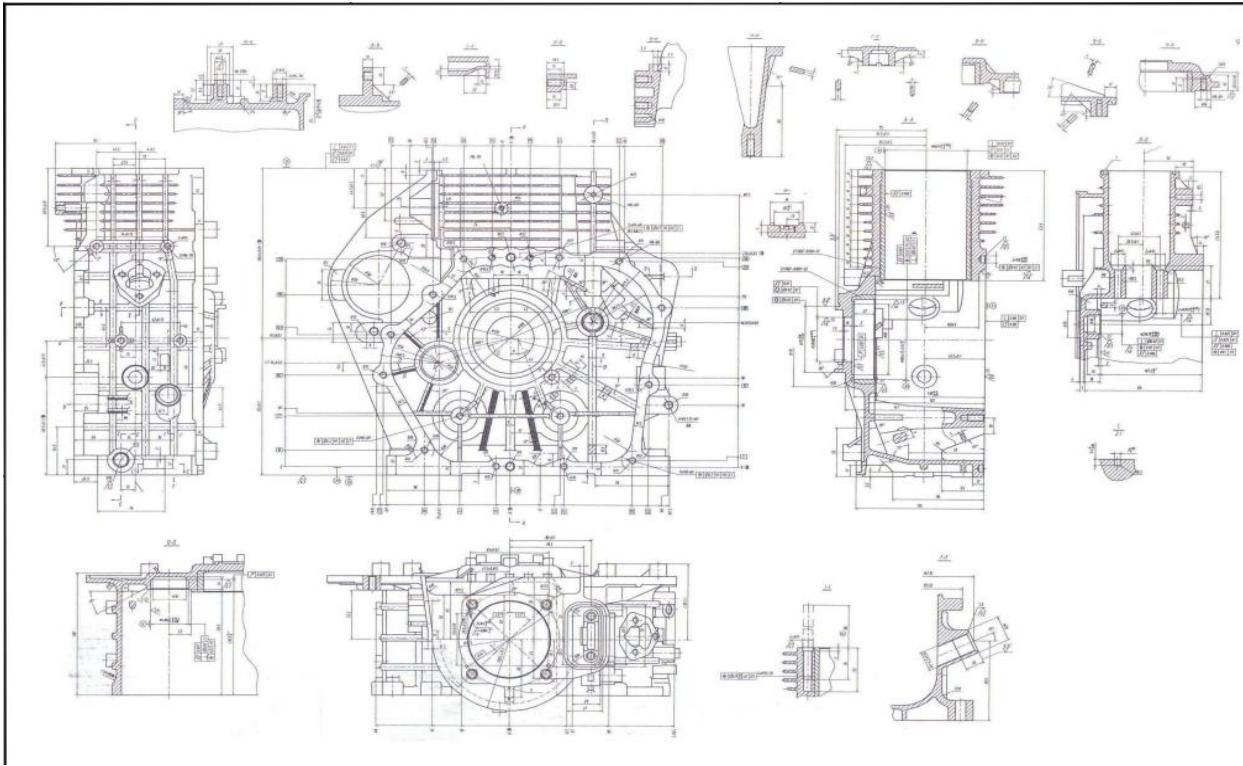


Some ISO documentation of Critical component Drawings- CH 196, 418 and 760-

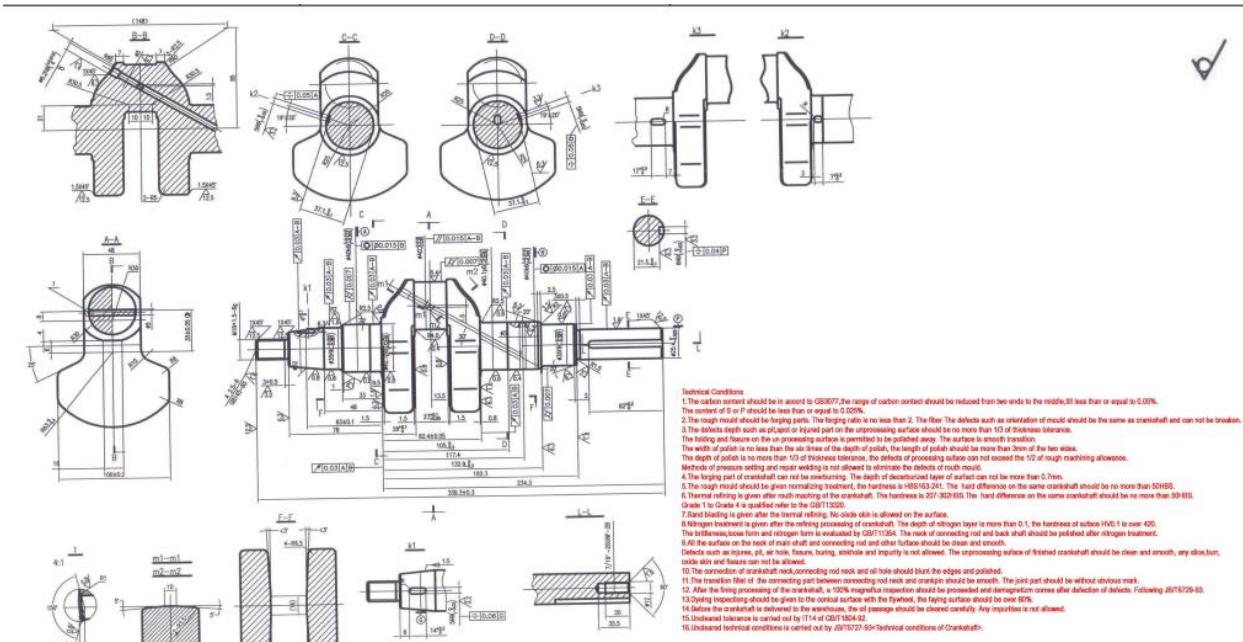
ISO & NABL DOCUMENTATION-CH 196



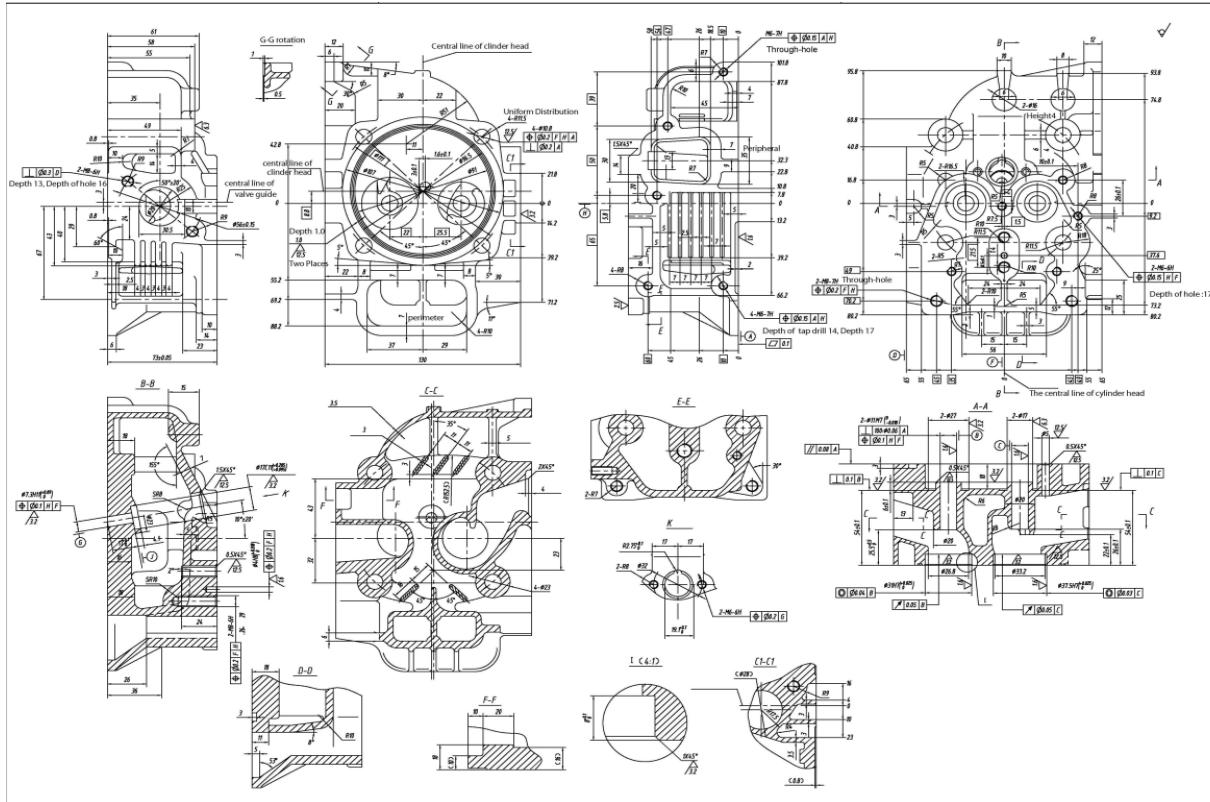
CH 418 individual GD&T Design and rework Examples-



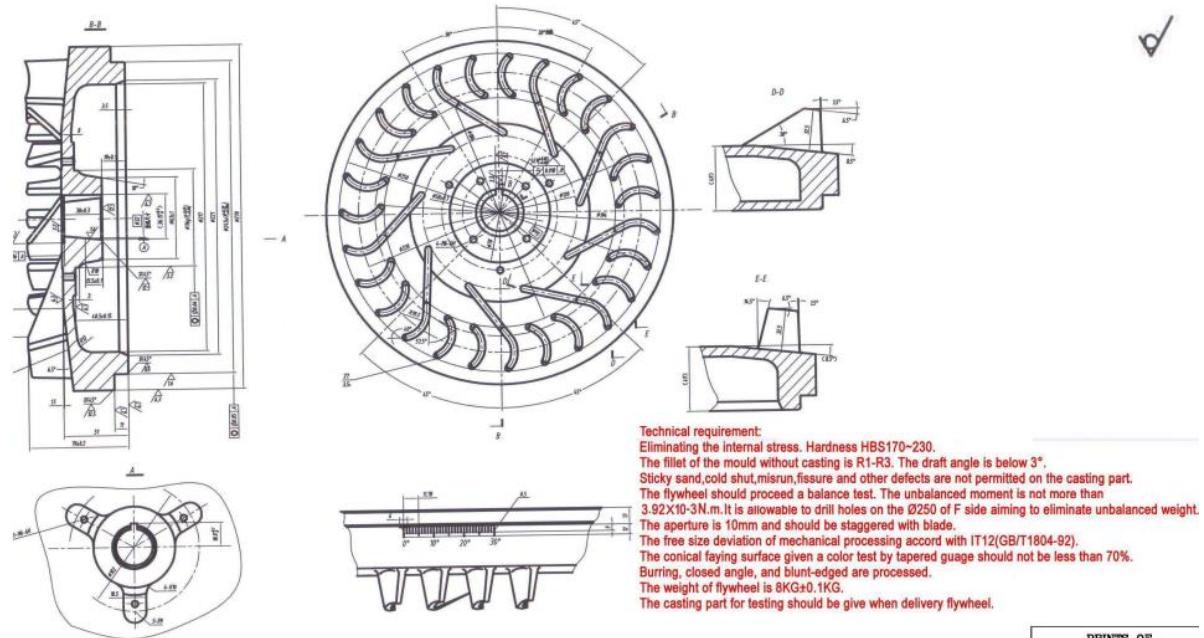
Crank Case



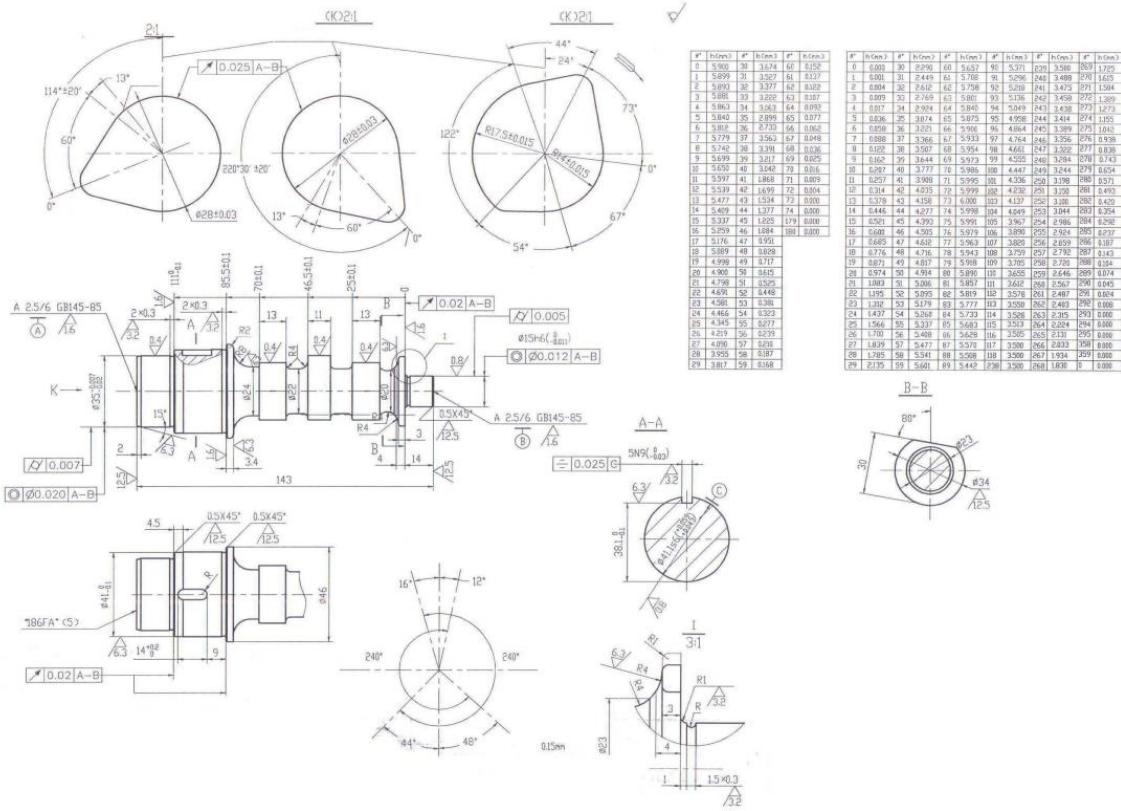
Crank Shaft



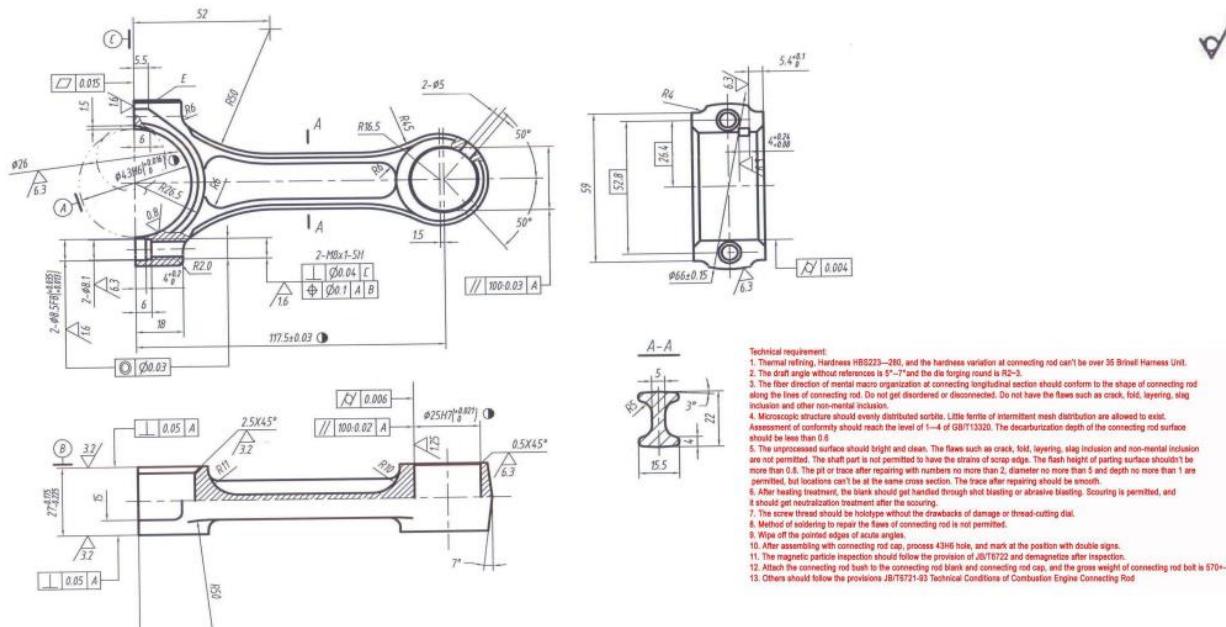
Cylinder Head



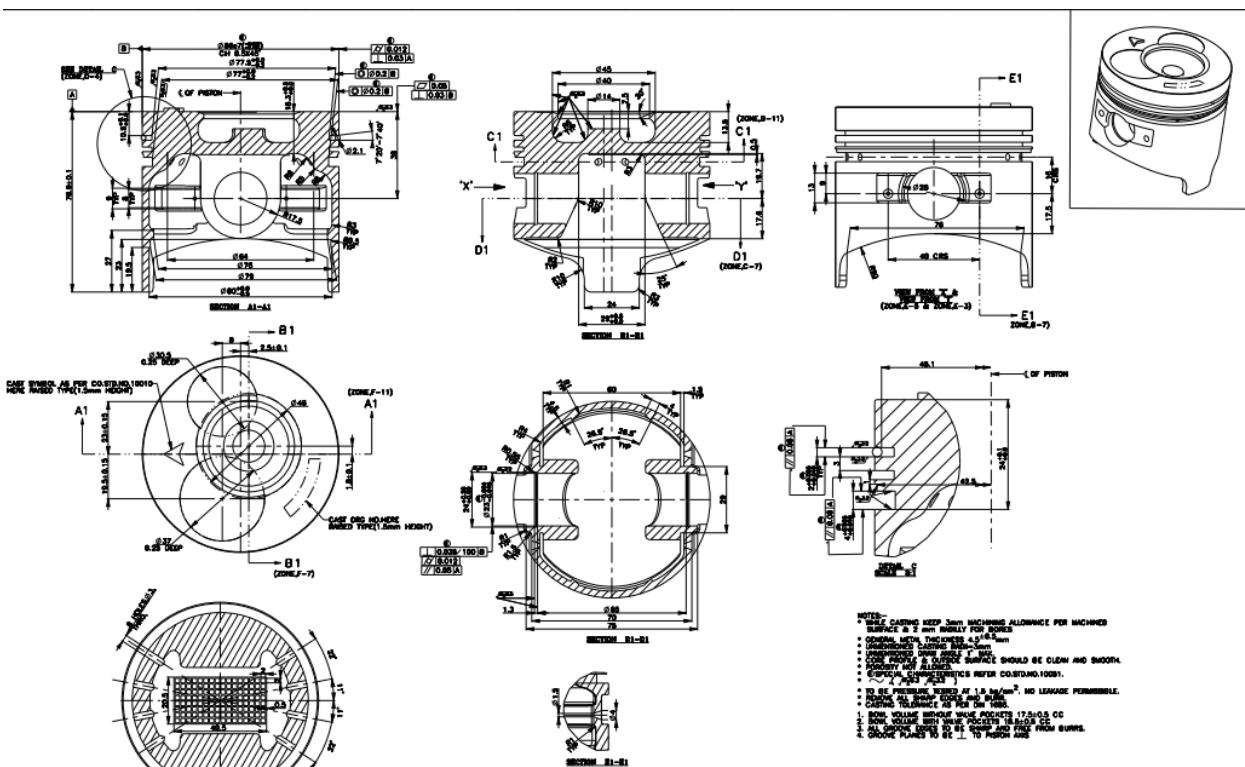
Flywheel



Cam Shaft

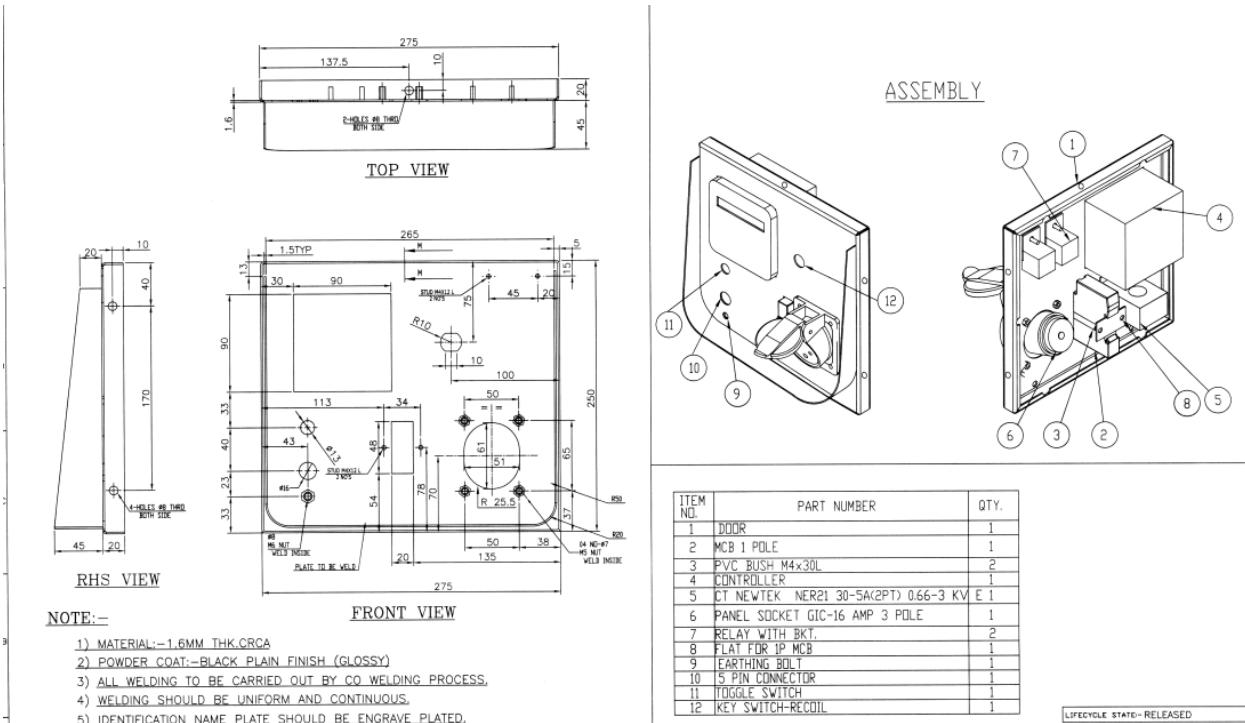


Connecting Rod

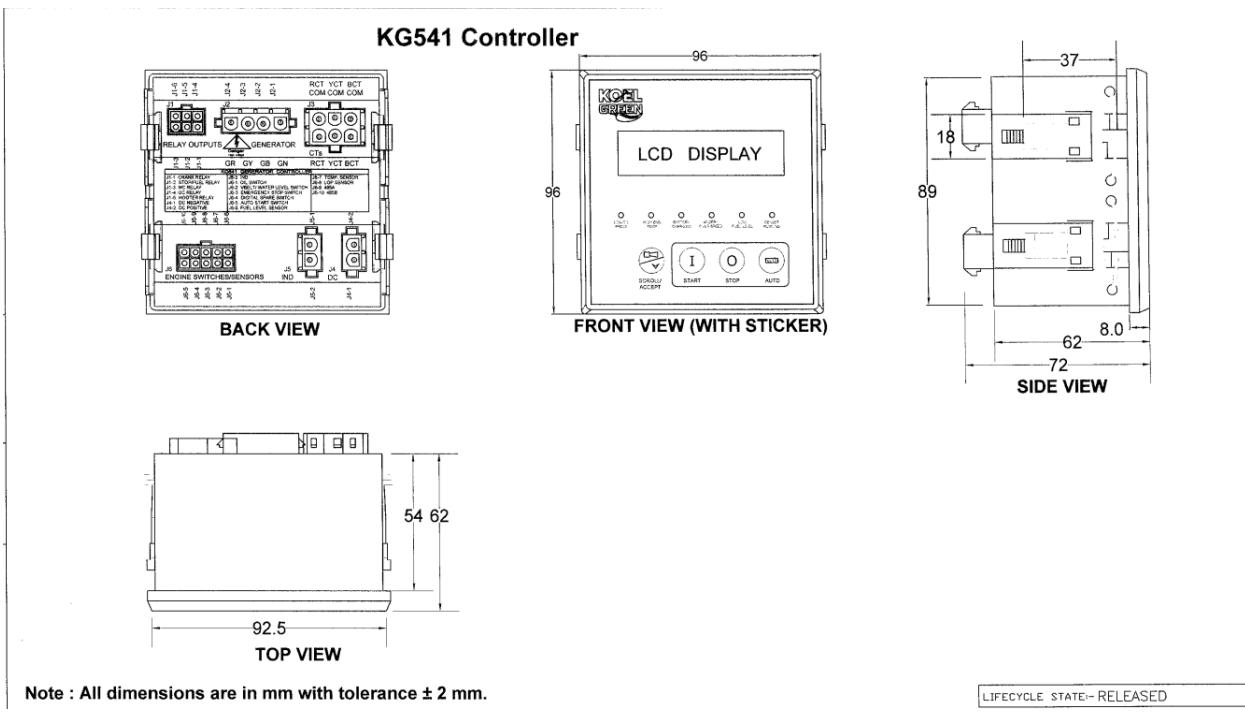


Piston Design

Some Electrical Design ISO's-



Control Panel



Note : All dimensions are in mm with tolerance ± 2 mm.

LIFECYCLE STATE - RELEASED

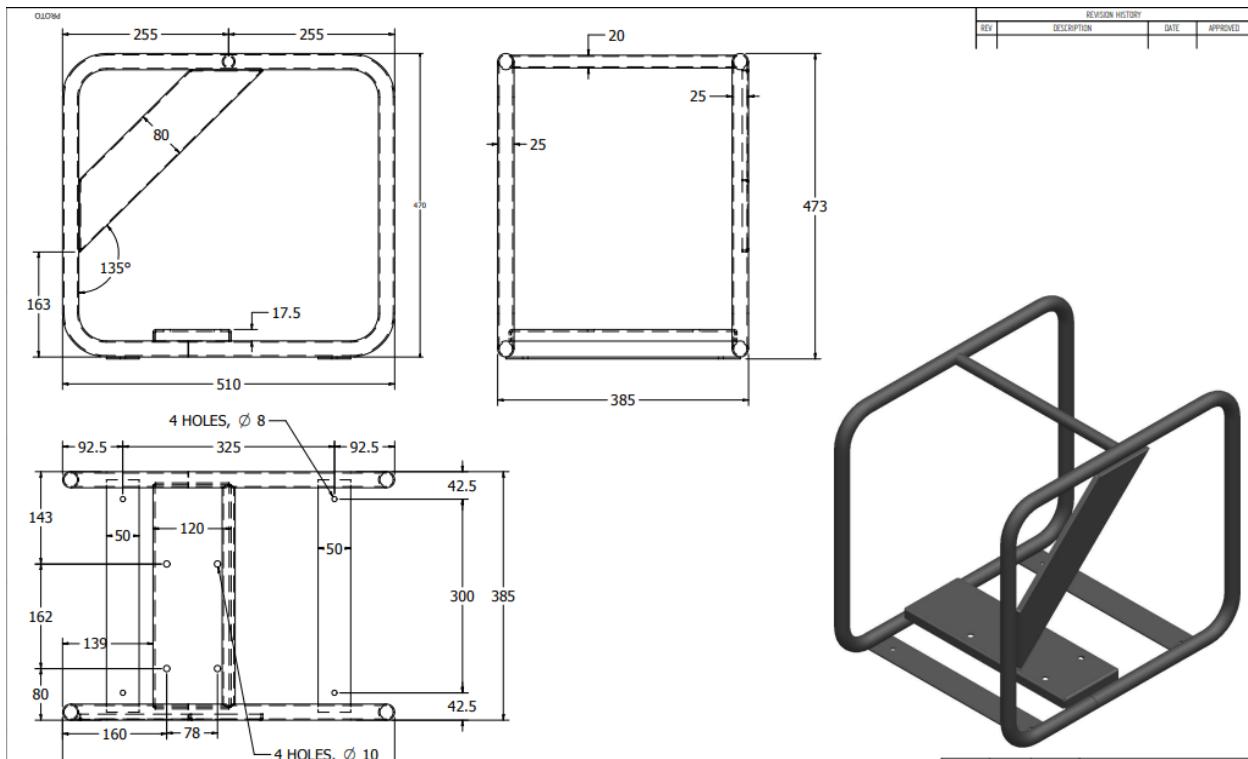
Controller Design

UNIT GENERAL SPECIFICATIONS		UNIT'S BACK SIDE MALE CONNECTOR'S DETAILS	
FEATURE	SPECIFICATIONS	MALE CONNECTOR NAME	PART NO.
Overall Dimension	96 x 96 x 72 mm (With Back Side Male Connector)	6 Pin Molex Male Connector	MLX 5566 - 06
Mounting Facility	Screwless Four Clamps (Press to Clamp Type)	10 Pin Molex Male Connector	MLX 5566 - 10
IP Rating	IP 56 Front Side	2 Pin Power Mate PMT Male Connector	2 Pin Power Mate PMT Male Connector
Supply Voltage	8 VDC to 30 VDC (Nominal Automotive)	4 Pin Power Mate Male Connector	4 Pin Power Mate PMT Male Connector
Operating Temp.	- 20 °C to + 70 °C	6 Pin Power Mate PMT Male Connector	6 Pin Power Mate PMT Male Connector
Storage Temp.	- 30 °C to + 70 °C		
Relative Humidity	90 % Non Condensing		
Supply Current	Standby \leq 53 mA (When LCD's Back Light is "OFF"). Standby \leq 108 mA (When LCD's Back Light is "ON").		
AC Voltage Range	L - N = 350 VRMS		
AC Frequency Range	45 - 65 Hz		
CT Current Range	0 - 5 A		
Input Reference	DC - / 0 VDC (i. e. Battery's Negative Terminal)		
Oil Pressure Sensor Type	Switch :- Close On Fault, Resistive :- 10 to 180 Ω		
Engine Temp. Sensor Type	Resistive (NTC) :- 0 to 530 Ω		
Fuel Level Sensor Type	Resistive :- 10 to 180 Ω		
Battery Volts Measurement	7 VDC to 30 VDC		
Terminations	Power Mate / Molex Mini Fit JNR		
Testings	Environmental Tests :- IEC68 Part 2. EMC Compliance :- IEC61000 - 4 - 4, EN61000 - 4 - 5, EN55022, EN61000 - 4 - 3.		
Weight	280 gms Approx.		
PANEL CUTOUT	91 X 91 MM		

LIFECYCLE STATE - RELEASED

Controller Spec Sheet

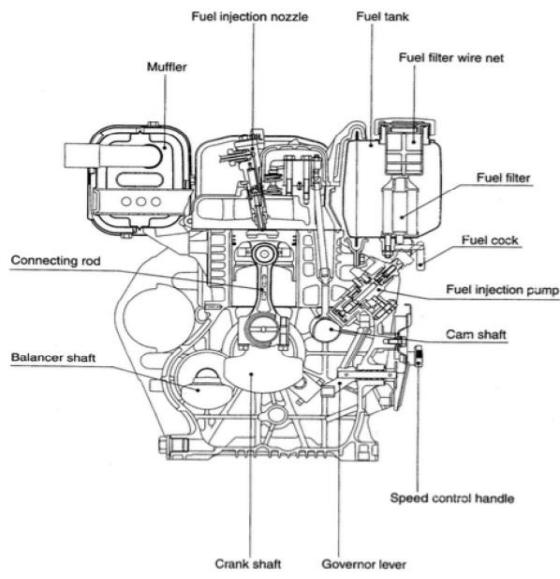
Water Pump-30 Frame Design-



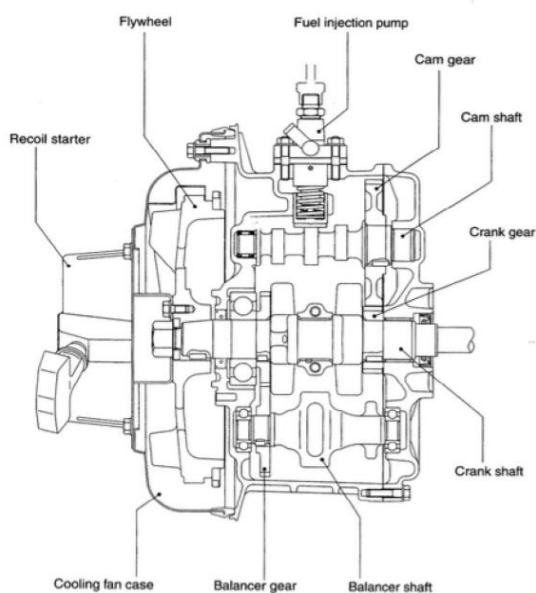
WP 30- CH-196 mounted

Service manual Example- CH 760-

Longitudinal sectional view



Plane view



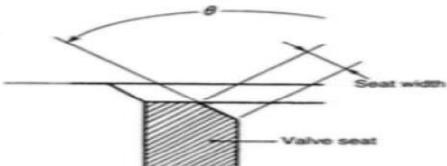
Checking and Servicing

CYLINDER HEAD

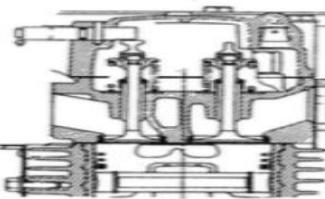
Combustion surfaces

Remove the fuel injection valve, intake valve, and exhaust valve. Clean the valve combustion surface and check for crack and other damage. Use the color penetrant to check for minute cracks.

Intake and exhaust valve seats
The valve seats are cold-fitted in the cylinder head to improve its wear resistance. Clean off carbon deposited on the valve seats since carbon build-up, excessive wear and corrosion can cause compression leaks.



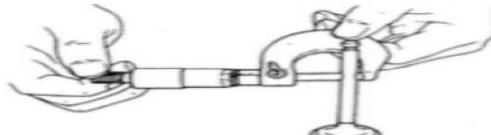
	Standard	Service limit
Seat angle (θ)	90°	—
Seat width	1.4	—



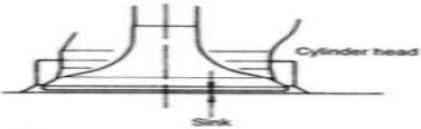
Intake/exhaust valve assembly

Intake/exhaust valves, and valve guides

- Check the valve stem for wear and distortion and replace if necessary. Do not confuse the intake and exhaust valve stems.



- Check the valves sinkage. Replace wornout valves (See service limits below).

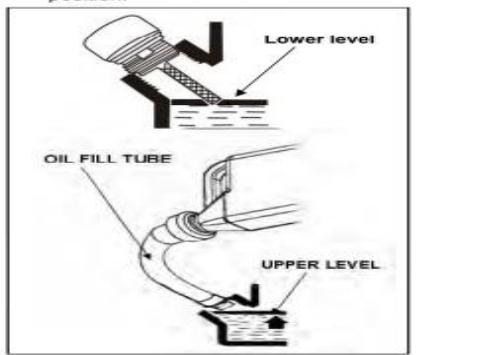


SECTION 3. MAINTENANCE

3-2 Engine Oil

NOTE: Drain the oil while the engine is still warm to assure rapid and complete draining.

- Remove the oil filler cap and drain plug.
- Drain the oil from the crankcase.
- Reinstall the drain plug securely.
- Add new oil up to the bottom edge of the oil filler hole with the engine stopped and in a level position.

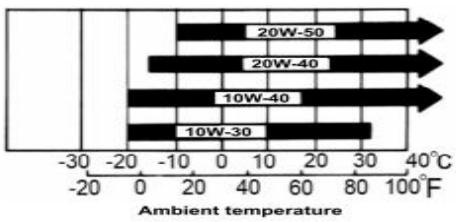


Engine Oil Capacity 1.16 US qt (1.1 L)

- Reinstall the oil filler cap and tighten it securely.

RECOMMENDED ENGINE OIL:

SAE 10W-30 is recommended for general, all temperature use. Service classification SG • SF/CC • CD.



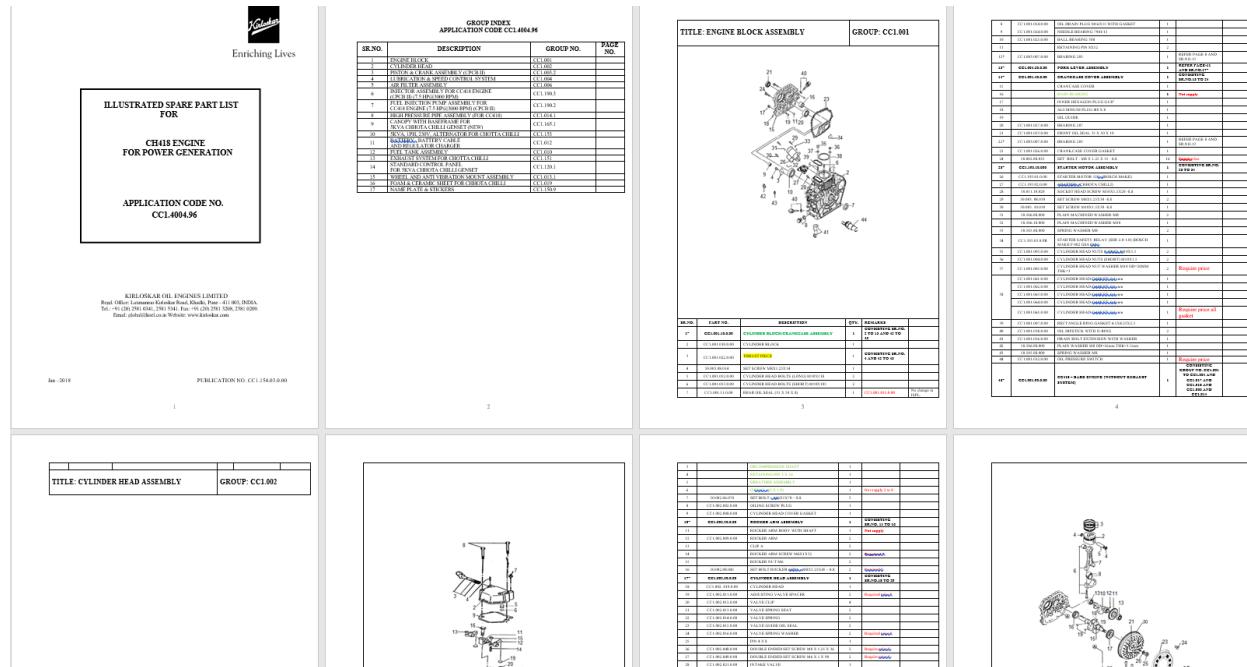
NOTE: Check the oil level BEFORE EACH USE with the generator on a level surface with the engine stopped.

- Remove the oil filler cap and wipe the dipstick clean.
- Check the oil level by inserting the dipstick into the filler neck without screwing it in.
- If the level is low, add the recommended oil to the upper mark on the dipstick.

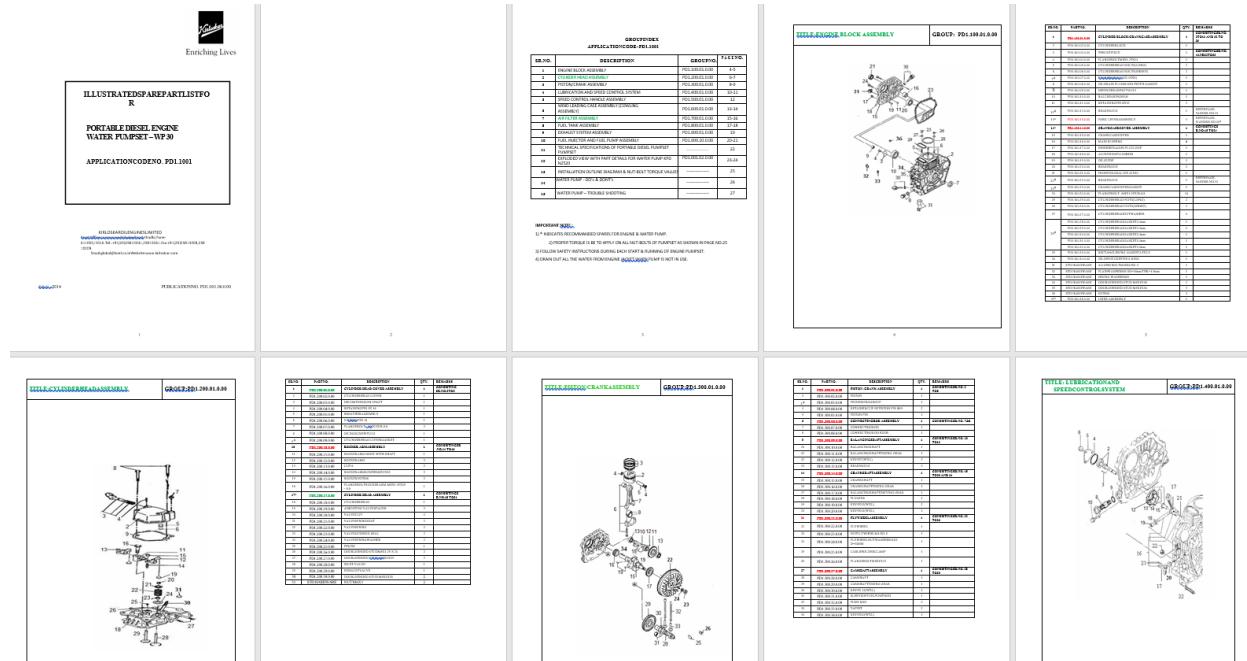
WARNING Used motor oil may cause skin cancer if repeatedly left in contact with the skin for prolonged periods. Thoroughly wash your hands with soap and water as soon as possible after handling used oil.

BOM example-

CH-418-



WP 30-



Manufacturing History Sheet- PFMEA/DFMA & CAPA Process-

Engine Assembly

Model : CH418

Champ Energy Ventures Pvt. Ltd.

Crankcase Number :

Manufacturing History Sheet

Sr.	Job Description	Remark	Operator's Name	Operator's Sign	Date
1	Visual Inspection for dents, damage, Crack, Loose fitment	Mark a dot with marker pen			
	Engine all Checkpoints sparkplug, ignition coil, oil Sensor working and oil Filling	Check continuity i.e indicator lamp 'ON'			
2	Head leakage checking and stud	Check with Petrol			
	Stud Fitment and Exhaust bend pipe fitment	Check full tightly fitted			
3	Application of oil to the liner	use fresh oil only			
	Cylinder Head assembly fitment with gasket and Torque = 32-35 Nm	Check position of gasket and mark with the marker pen			
4	Push rod inserting & valve cap fitment				
	Tappet setting	Inlet = 0.10 mm Exhaust = 0.15 mm			
	Tappet cover gasket and cover fitment	Tappet Cover Torque = 8-10 Nm			
5	Fan case & Recoil Assembly	Torque = 8-10 Nm			
	Speed regulating plate fitting	Torque = 8-10 Nm			
	Close the end of Exhaust bend pipe by Packing Tape				
6	Spring choke Carburetor inserting with insulator				
	Choke plate fitment				
	Governor assembly fitment and governor setting				
	Close the Venturi of carburetor by packing tape				
7	Engine cowling lower				
Alternator Assembly					
1	Take Stator and Rotor pair for assembly				
2	Check torque of stator duly assembled with rear frame	Torque = 4 to 7 Nm			
3	Tightening of rotor on engine crankshaft	Rotor bolt Torque = 35 to 40 Nm			
4	Align rotor and stator	Torque = 8 to 12 Nm			
5	Engine-Alternator carbon brush and connector plate fitment	Completed			
6	Change 4 Pin connector male	Completed			
7	Mention Alternator number	SC			
Genset Assembly					

Champ Energy Ventures Pvt. Ltd.

Battery No:

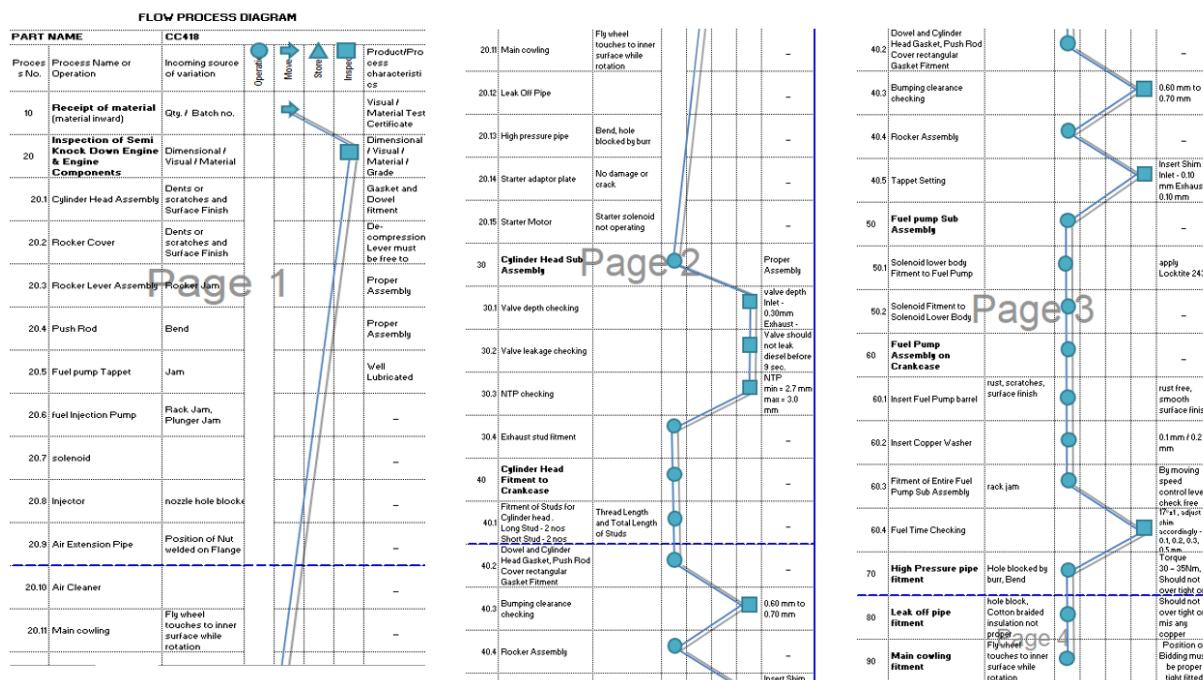
Sr	Job Description	Remark	Operator's Name	Sign	Date
1	Wheel fitting - fit rotating wheel to exhaust side (RH side) and fit fix wheel to air filter side (LH side)	Completed			
2	Foundation fitment - fit smaller AVM to front side(oil tray side) and big size AVM to back side (opposite side)	Completed			
3	Mount engine alternator assembly on base and tighten	Completed			
4	a) Fit muffler lower box , muffler bend ,muffler with gasket b) Fit dummy air filter for filtering. C) Add 400 ml. engine oil in the engine and check oil level D) Fit battery charger, battery charger connector (female)	Completed			
5	Do primary load testing of engine alternator - Mittuwa Minutes testing at full load. Follow following steps for testing. a) Connect AC output connection from alternator to load bank. b) Connect fuel connection. c)Start engine, do RPM setting from 3160 to 3200 for no load and 3000 to 3030 for full load. d)Do voltage setting of 230 V at full load and observe no load voltage, it should not cross 235 V. e) Check battery charger voltage, the same should be within the range of 12 to 15 V. f) Check noise from alternator, engine and muffler – there should not be any abnormality in the noise.	Completed			
6	Fit partition plate, air filter along with bracket. Insert and pass the fuel pipe from the fuel pipe hole.	Completed			
7	Fit muffler top cover and back panel	Completed			
8	Fit LH panel , connect fuel pipe to fuel cock	Completed			
9	Fit Front panel to base.fit control panel to front panel and do wire assembly, check all wire connections it should be tight fit with cable tie. Choke cable fitment. Fit alternator duct.	Completed			
10	Fit RHS panel to base. Fit noise damper on RHS panel. Stick exhaust sticker on Damper	Completed			
11	Fit fuel tank to Top panel. Fit top panel assembly and	Completed			
12	Paste stickers on genset as per specified locations.	Completed			

Final Testing

Load in %	Load in watts	Current in Ampere	Voltage	Frequency	Engine rpm	Q.C Remark and Checked by
0						
25						
50						
75						
100						
Name of Operator	Sign of Operator		Date			
Sr	Check Point	Inspection Parameter	Method of Inspection			
1	Engine ON/OFF switch	Operational Check	Manual			
2	Voltmeter, Ammeter Check	Operational Check	Visual			
3	Hour meter operation	Rotation of Digits	Visual			
4	Choke cable operation	Easy operation	Visual			
5	All nuts and bolts	Proper fitment	Visual			
6	Door Operation	Easy movement	Visual			
7	Sticker pasting	Proper pasting at specified locations	Visual			
8	Check for any surface damage	Scratches, dents and damage	Visual			

PFME Assembly Costing-

PFMEA- PFD



Process flow chart with details of costing (Total 6 Pages)										
Champ Energy Ventures Pvt. Ltd.				Symbols		Costing Details (Direct labour costs on the basis of activity based costing)				
Part No.:				Movement	Storage	Details of activity based costing				
Part Description: PETROL				Operation	Inspection	Labour rates per man month				
Customer: Kirloskar Oil Engines Ltd.				Operation		Effort required per unit (Min)	Volume of units/day	Total Man-hours/day	% of people required	Skilled
r.No	Operation/Process Description	Operation No.	Incoming source of variation	Symbol	Product/Process Characteristics	Manpower (Semi-skilled, Skilled, Unskilled, G1, G2, G3, G4, G5, G6)	G1 to G6	G1 to G6 and P1 to P4	Semi-skilled	Semi-skilled
22	Cowley Base Sub Assembly		—	●	—		20			Unskilled
	a) Filament of wheels on Base		Tapping problem		—	G1+G2	3	20		
	b) Filament of H.I.M on Base		—		—	G1+G2	4	20		
22	Muffler Box Sub Assembly			●			20			
	a) Ceramic Fasting on Lower Muffler Box					G3	3	20		
	b) Ceramic Fasting on Upper Muffler Box					G3	3	20		
350	Engine Partition Sub Assembly			●			20			
	a) Cutting of Bidding					G4	3	20		
	b) Fitting of Bidding on Engine Partition Plate for Recoil					G4	2	20		
	c) Fitting of Rubber Grommet on Engine Partition Plate					G4	1	20		
22	Frost Panel Sub Assembly			●			20			
	a) Control Panel Filament into Front Panel					G5	3	20		
370	Alternator Partition Panel Sub Assembly			●			20			
	a) Ceramic Fasting on Alternator Partition Panel					G6	3	20		
22	RH Panel Sub Assembly			●			20			
	a) Ceramic Fasting on RH Panel					G6	3	20		

ISO and NABL Documentation Example-

Name	Date modified	Type	Size
1) Development Enquiry Record DDE_F_0...	10/26/2017 2:06 AM	Microsoft Excel 97...	23 KB
2) Design and Development Planning DD...	10/26/2017 2:08 AM	Microsoft Excel 97...	23 KB
3) Design Input DDE_F_03.xls	10/26/2017 2:09 AM	Microsoft Excel 97...	29 KB
4) List of Design Outputs.xls	10/26/2017 2:10 AM	Microsoft Excel 97...	22 KB
5) Design development review report DD...	10/26/2017 2:11 AM	Microsoft Excel 97...	23 KB
6) Design Output and Review Report .xls	10/26/2017 2:11 AM	Microsoft Excel 97...	23 KB
7) Design verification plan and report - .xls	10/26/2017 2:12 AM	Microsoft Excel 97...	24 KB
8) Design validation.xls	10/26/2017 2:13 AM	Microsoft Excel 97...	23 KB
9) Design Changes.xls	10/26/2017 2:13 AM	Microsoft Excel 97...	22 KB
10) Risk Assessment.xls	10/26/2017 2:15 AM	Microsoft Excel 97...	23 KB

Customer complaint record-

Customer Complaint Record (KOEL)

Complaint No.	Date of Receipt	From	Customer Complaint	CAR Status	Actions Completed	Review Status	Review sign.	Closed Out
1	10/4/2017		batch clearance of CC418 & Power weeder Engine observed major issues enclosed below 1. CC418 K17020220-Inlet valve leakage. 2. Power weeder k17020338-Exhaust valve leakage.					
2	May-18		1. 5 KVA Genset doesn't stop by controller-Controller faultyGenset doesn't stop by controller 2. Genset tripping with indication of Low voltage- 3. 3KVA Fuel solenoid not working. Controller faulty	The problem communicated to controller supplier and instructed to initiated proper corrective action.				
3	Jan-18		Genset misfire due to FIP faulty					
4			Genset tripping due to air trapping issue (FIP Faulty)					
5			Control panel diode missing					
6			Genset starting trouble-LOP Switch open (LOP Wire loose from 6 pin connector)	Defect explained to control panel assembly operators.	Defect explained to control panel assembly operators.			
7			Battery charger faulty(Not working & High voltage)					
8			Engine-Crankcase Broken near balancing shaft at flywheel side					
9			Alternator earthing wire pinched due to stuck up b/w Control panel mtg. plate					
10			Controller not showing AMP,KW reading -S1CT Wire cut from lug joint					
11			Controller loose-controller	The defect communicated to supplier>Action				

Customer Complaint Record (KOEL)

Complaint No.	Date of Receipt	Product	Customer Complaint	CAR Status
1	20.11.2017	Fuel Tank 8 HP	Fuel tank drain bolt leakage..	Completed
2	25.10.2017	PW- 8 HP	Low oil pressure (1.5 kg/cm2).	Completed
3	25.10.2017	CC-418 PG Engine	Noise in engine.	Completed
4	25.10.2017	CC-418 PG Engine	Engine jam-Bumping clearance shim missing & metallic wire found on piston.	Completed
5	29.08.2017	PW- 8 HP	Recoil position wrong.	Completed
6	29.08.2017	PW- 8 HP	High pressure pipe fouls to fuel tank bottom.	Completed
7	29.08.2017	PW- 8 HP	FIP to tank hose clamp position wrong.	Completed
8	29.08.2017	PW- 8 HP	Air filter clamp fouls to flywheel cowling while removing.	Completed
9	29.08.2017	PW- 8 HP	Heavy burr observed in air filter bowl.	Completed
10	29.08.2017	PW- 8 HP	Leak off pipe clamp observed in air filter bowl.	Completed
11	07.08.2017	CC-418 Engine	Fuel leakage from solenoid body joint	Completed
12	07.08.2017	CC-418 Engine	Oil pressure not showing in dial gauge-Oil gallery blocked (K17060029)	Completed
13	07.08.2017	5 Kva Genset	Engine misfire, Red hot (FIP issue)	Completed
14	07.08.2017	CC-418 Engine	MCB trip at 16.6 AMP against 17.5 AMP(MCB Faulty)	Completed
15	07.08.2017	CC-418 Engine	Muffler leakage(Hole on body)	Completed
16	06.07.2017	CC-418 Engine (Battery charger)	Battery charger not working.	Completed
17	06.07.2017	CC1.4007 Genset	Genset directly starting by battery connection even controller off-Controller faulty	Completed

Corrective Action and CAPA process-

CORRECTIVE ACTION CAPA

CAR NO. : December- 01		Date: 20.12.2017			
Part Description: PW- 8 HP		Part No.: P08.1001.800PR			
When Observed (Date / Period) : October 2017		Non-conformance Reported at : Receipt and Process stage			
A) NON CONFORMANCE STATEMENT : (Describe what? What extent? When? What impact? Where? Etc.)					
Fuel tank drain bolt leakage..		No.of Defective 3 Lot Quantity -			
B) ACTION TAKEN TO DISPOSE NON -CONFORMING PARTS: (Describe what immediate action to contain the nonconformity & action on the nonconformity e.g. Additional inspection, Sorting, rework, repair, concession, etc..) <i>New washer fitted, drain bolt tightened in proper manner and confirmed that there is no leakage. Fuel tanks 118 Nos. available at CEVPL will be checked 100% for leakage.</i>					
C) ANALYSIS : (Use C & E diagram, Master Cause Analysis & Why Why Analysis wherever required). <i>Operator mistake</i>					
D) CORRECTIVE ACTION PLAN: (Actions planned to avoid recurrence)					
Sr. No.	Major causes identified	Action Plan	Action By	Target Date	Comp. On
1	Overtightening of drain bolt	Operators explained not to overtight the drain bolt.	CEVPL	28.11.2017	
E)	CORRECTIVE ACTION PLANNED IN SIMILAR PARTS/CASES ACROSS DEPT./ PRODUCTS/ PLANT (Horizontal deployment)				
-					
F)	EFFECTIVENESS MONITORING :				
PPM Rejection or Number of Defectives for the reported Non conformance					
Month					
G)	PREVENT RECURRENT : (Specify the WI change, Procedure change,FMEA, Process change,etc. Mention document no.)				
-					
(Attach the updated documents along with the CAP)					
H)	CONCLUSION: <i>The problem will not come again as the action has been implemented at supplier end.</i>			Date closed:	

Major Issue Resolution- Risk Assessment last page-

CEVPL major issues DEC-17								
Sr. No.	Complaints	Qty.	Model	Category	Root cause	Action taken & decided	Responsibility	Status
1	Genset doesn't stop by controller-Controller fault	2	5KVA	Genset testing & PDI				
2	Genset tripping with indication of Low voltage- Controller faulty	1	5KVA	Genset testing				
3	Genset not cranking by control panel	2	5KVA	Genset assembly				
4	Fuel solenoid not working-controller Faulty	1	3KVA	Genset testing				
5	Controller not working	1	3KVA	Genset testing	Faulty controller	The problem communicated to controller supplier and instructed to initiated proper corrective action.	CEVPL	Under monitoring
6	Genset misfire due to FIP faulty	3	5KVA	Genset testing				
7	Genset tripping due to air trapping issue (FIP Faulty)	1	5KVA	Genset testing				
8	Control panel diode missing	1	5KVA	Genset assembly				
9	Genset starting trouble-LOP Switch open (LOP Wire loose from 6 pin connector)	3	5KVA	Genset testing	Operator mistake	Defect explained to control panel assembly operators.	CEVPL	Under monitoring
10	Battery charger faulty(Not working & High voltage)	3	5KVA	Genset testing				
11	Engine-Crankcase Broken near balancing shaft at flywheel side	1	CC418	Engine testing				
12	Alternator earthing wire pinched due to stuck up b/w Control panel mtg. plate	1	5KVA	PDI				
13	Controller not showing AMP,KW reading	1	5KVA	Genset testing	S1 CT Wire cut from lug joint			
14	Controller loose-controller mtg.clamp locking step missing.	1	3KVA	Genset assembly	Inspection lapse at supplier end	The defect communicated to supplier. Action related to controller clips initiated at supplier.	CEVPL	Under monitoring
15	Engine-Charging coil not working	1	CC418	Primary testing				

Updated DFMEA and PFMEA-

Work Instruction – Engine Assembly

Product : CH418 PW Diesel Engine			Main Assembly- 06		
Document No. : WI-Prod-09		Issue No.: 06/Date : 28.01.2018	Operation : Cowling Fitment.(MA-06)		
Sr. No.	Details of activity	Visuals	Tools	Important Parameters	Method of Inspection
1	Cylinder head cover fitment (with oil cap) with gasket.		Torque gauge	Torque – 8-10 Nm with grease application to gasket.	Visual
2	Check high pressure pipe be not fouled to tank after fitment. Check that FIP inlet pipe must not be pinched and clamps must be fitted as per shown in the Photo only.				
3	Check freeness of engine by rotating the flywheel and apply oil to cylinder liner and tappet.	-----	-----	Tappet must move up and down while rotating the flywheel.	Hand rotation
4	Fit recoil pulley on flywheel as shown in Photo. Fit air filter on inlet port such that clamp must not be fouled to tank. Also fit muffler on exhaust port. Fit tank mounting bracket on cylinder head, insert gromet on the tank resting location and fit fuel tank on the bracket, insert and tight two bolts.		M10 'T' spanner.	Position of bidding should be proper. No damage to wind leading case mounting thread.	Visual

Design, Quality and Assembly line Re-work & Calibration Updates-

Master List of Gauges and Instruments										
Sr. No.	Name of Instrument/Gauge	Make	I.D. Number	I.D. Number by Champ	Least count / Range	Calibration Frequency	Calibration Date	Due Date	Location	Remark
1	Torque wrench	Torque	TM -10	CHI/TW/01	3-14 Nm					
2	Torque wrench	Mac Master	TV -10	CHI/TW/02	3-14 Nm				QUALITY	
3	Torque wrench	Torque	TM 10	CHI/TW/03	3-14 Nm				QUALITY	
4	Torque wrench	Torque Master	TM 10	CHI/TW/04	3-14 Nm				QUALITY	CUPBOARD
5	Torque wrench	Torque	TM 10	CHI/TW/05	3-14 Nm				QUALITY	
6	Torque wrench	Torque	TM 10	CHI/TW/06	3-14 Nm				QUALITY	
7	Torque wrench	Torque	TM 10	CHI/TW/07	3-14 Nm				QUALITY	
8	Torque wrench	Torque	TM 10	CHI/TW/08	3-14 Nm				QUALITY	
9	Torque wrench	Torque	TM 10	CHI/TW/09	3-14 Nm				QUALITY	
10	Torque wrench	Torque	TM 25	CHI/TW/10	5-35 Nm					
11	Torque wrench	Torque	TM 25	CHI/TW/11	5-35 Nm				ENGINE	
12	Torque wrench	Giphold	GTW-25	CHI/TW/12	5-35 Nm				ENGINE	
13	Torque wrench	Protocol	PTW- 25	CHI/TW/14	5-35 Nm				ENGINE	
14	Torque wrench	Torque	TM 25	CHI/TW/15	5-35 Nm				QUALITY	
15	Torque wrench	Torque Master	TM 25	CHI/TW/16	5-35 Nm				QUALITY	CUPBOARD
16	Torque wrench	Torque		CHI/TW/17	5-35 Nm				ENGINE	
17	Torque wrench	Torque	TM 50	CHI/TW/19	14-68 Nm				ENGINE	
18	Torque wrench	Torque	TM 100	CHI/TW/20	25-135 Nm				QUALITY	
19	Torque wrench	Mac Master	19D-68	CHI/TW/21	50-225Nm				ENGINE	CC418
20	Torque wrench	Mac Master	20-G-90		3-14 Nm				QUALITY	
21	Torque wrench	Mac Master	20-G-91		3-14 Nm				QUALITY	
22	Torque wrench	Mac Master	20-G-92		3-14 Nm				QUALITY	
23	Torque wrench	Mac Master	20-G-101		3-14 Nm				QUALITY	
24	Torque wrench	Mac Master	20-A-42		5-35 Nm				QUALITY	
25	Torque wrench	Mac Master	20-A-43		5-35 Nm				QUALITY	
26	Torque wrench	Mac Master	20-A-44		5-35 Nm				QUALITY	
27	Torque wrench	Mac Master	20-A-49		5-35 Nm				QUALITY	
28	Torque wrench	Mac Master	20-A-52		5-35 Nm				QUALITY	
29	Torque wrench	TOHNICHI	143852B	CHI-RTW-01	10-50Nm				ENGINE	
30	Allen key		cut key		14 MM				QUALITY	
31	Sound Level Meter	TES 1350A	308070793		35-135 DB					
32	Sound Level Meter	CENTER 329	91000561		40-130 DB				QUALITY	
33	Steel Scale	KRISTEEL - Shinwa			0-300 mm				QUALITY	CUPBOARD
34	Steel Scale	KRISTEEL - Shinwa			0-600 mm				QUALITY	CUPBOARD
35	Steel Scale	KRISTEEL - Shinwa			0-600 mm				QUALITY	CUPBOARD
36	Feeler Gauge	ATAL			0.1				QUALITY	
37	Feeler Gauge	ATAL			0.15				QUALITY	
38	Feeler Gauge	ATAL			0.4				QUALITY	
39	Hex Socket Set Box	TAFARIA	CS3/8H	BOX SOCKET SET UNIT - 1	14 Socket 6 Accessories				QUALITY	CUPBOARD
40	Pulse Engine Tachometer	OPPAMA	PET-1000R	PET 01					QUALITY	NEW
41	Pulse Engine Tachometer	OPPAMA	PET-1000R	PET 02					QUALITY	CUPBOARD
42	Pulse Engine	OPPAMA	PET-1000R	PET 03					QUALITY	NEW

CPCB 2 Reworked- Engine Endurance and Governor Testing Examples for New Testbed system and

Cycle Design- CH 418

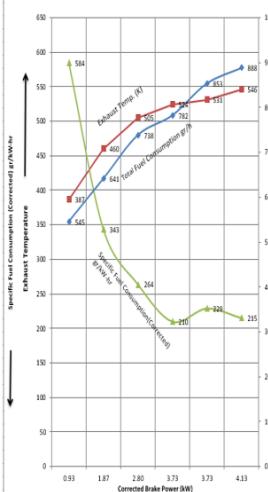
IN-HOUSE CH 418 ENGINE ENDURANCE TESTING-

Type rating test report as per IS:11170:1985/10001:1982								418 Engine Endurance test Report										Date	26.02.2018			
Type	No. of Cylinder	Bore	Mechanical Efficiency	CH	Engine Sr. No.	13-02-003	Appl. Code	Fuel Sp. Gravity	Oil sp. Gravity	Altitude	60 met	BED NO.	3									
		1		82 MM		Brake Power hp	6.14.4	Rated rpm	3600	Declared SFC	1 gmnsk	BED NO.	3									
		82 MM		Stroke		66 MM	Compression Ra	20:1	Bulb capacity in c	25	Air Cleaner Type	Bath t	Electric									
		80%		Engine Cooling		AIR	Fuel Timing	17 Deg	Fuel Pump Make	mico	Lubricant	Dynamometer Cd	9544.2									
S.No.	Date	Time	Load in %	Dry Bulb Temp.	Wet Bulb Temp.	Air In Temp.	Brake Load in Nm	Measured RPM	Brake Power (Measured red) in kW	Correct ion factor for Power	Brake Power Correct ed in [kW]	Time for 50% Consumption (Observed in sec)	Total Fuel Consumpti on (hrs.kw.)	Observed SFC in grs./hrs.kw.hrs	Correct ion factor for SFC	Exhaust Temp. in deg. C	Cr. case Pr. mm of H2O	Exhaust Back Pr. mm of H2O	Lube Oil Pr. in Kg/cm2	Lube Oil Temp. in (Deg C)	Smoke in bo	Remark
Cycle 26		6.00 AM	100%	24	19	25	11.1	3604	4.2	0.9449	4.4	1314	1144	273	10087	271	460	-130	40	4.3	88	2.356
409	6.4.2013	7.00 AM	100%	24	19	25	11.1	3608	4.2	0.9392	4.5	1256	1197	285	10096	283	369	-135	35	4.2	89	2.072
410	7.4.2013	8.00 AM	100%	26	21	27	11.1	3608	4.2	0.9383	4.5	1340	1221	268	10098	266	440	-135	30	4.1	90	3.235
411	6.4.2013	9.00 AM	100%	28	21	29	11.1	3598	4.2	0.9383	4.5	1340	1221	268	10098	274	470	-130	30	3.8	95	2.678
412	6.4.2013	10.00 AM	100%	31	22	32	11.1	3599	4.2	0.9364	4.5	1300	1156	276	10101	376	242	-130	30	4.4	95	1.650
413	6.4.2013	11.00 AM	50%	34	23	35	5.4	3636	2.1	0.9300	2.2	1924	781	380	10112	376	242	-130	30	4.4	95	1.373
414	6.4.2013	12.00 AM	50%	35	24	36	5.4	3635	2.1	0.9280	2.2	1918	784	381	10116	377	245	-130	35	4.0	87	1.373
415	6.4.2013	1.00 PM	50%	37	24	38	5.4	3631	2.1	0.9241	2.2	1922	782	381	10122	376	247	-130	30	4.0	88	1.483
416	6.4.2013	2.00 PM	50%	38	26	39	5.4	3632	2.1	0.9223	2.2	1922	782	381	10126	376	246	-130	30	4.0	89	1.502
417	6.4.2013	3.00 PM	110%	39	26	40	12.1	3600	4.6	0.9204	5.0	1274	1180	259	10123	255	328	-135	35	3.4	100	1.820
418	6.4.2013	3.30 PM	0%	36	25	37	0	3656	-	0.9261	-	2344	511	-	10119	-	178	-130	30	4.6	89	0.436
419	6.4.2013	4.30 PM	100%	35	24	36	11.1	3606	4.2	0.9280	4.5	1198	1255	239	10116	236	325	-145	35	3.6	98	2.639
420	6.4.2013	5.30 PM	100%	35	24	36	11.1	3608	4.2	0.9280	4.5	1208	1244	297	10116	233	318	-145	35	3.7	96	2.901
421	6.4.2013	6.30 PM	100%	33	23	34	11.1	3564	4.1	0.9321	4.4	1204	1248	306	10108	303	314	-130	35	3.8	93	3.026
422	6.4.2013	7.30 PM	50%	31	23	32	5.4	3640	2.1	0.9364	2.2	1938	776	377	10101	373	230	-125	30	4.3	86	0.992
423	6.4.2013	8.30 PM	50%	29	24	30	5.4	3637	2.1	0.9306	2.2	1940	775	377	10111	373	227	-120	30	4.5	84	1.160
424	6.4.2013	9.30 PM	50%	28	22	29	5.4	3637	2.1	0.9383	2.2	1984	758	368	10098	365	221	-120	30	4.5	83	1.138
425	6.4.2013	10.00 PM	50%	27	22	28	5.4	3638	2.1	0.9363	2.2	1928	780	379	10101	375	214	-125	30	4.6	80	0.842

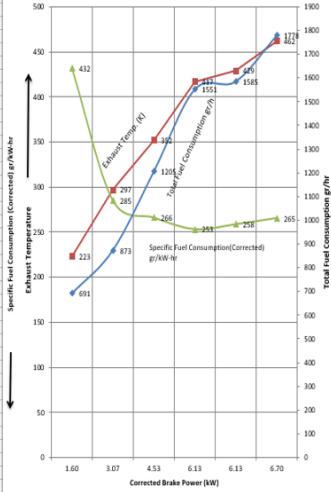
SHORT PERFORMANCE TESTING- CH 196

TESTING OF CONSTANT SPEED IC ENGINES FOR GENERAL PURPOSE IS:10001																				
12 Hour Rating Test As Per IS:10000 Part-VIII Clause 2.1.3																				
Name of the Engine Manufacturer																				
Type:	Air Cooled	Sheet No.	1 of																	
Model:	CH 196	Altitude(m)	560																	
Engine No.:		Nominal Compression Ratio :	20:01																	
No. of Cyl. :	1	Fuel Specification :																		
Rated Speed(n) rev/min :	3600	Calorific value :	42000 KJ/KG																	
Rated Brake Power (P) kW:	5.5	Manufacturer's recommended Grade of Oil:																		
Bore 86 mm, Stroke 72 mm		Dynamometer Type :	Electric Dynamometer																	
Cubic Capacity Litres		Specific Gravity	0.81 gm/mm ³																	
Mechanical Efficiency(η_m) :	80%																			
Place of Test:	Pune	Date:																		
Testing Laboratory:	Champ																			
Observers:																				
S.No.	Time	Temperatures																		
		Wet Bulb	SC.	Bdry Bulb	SC.	Air Strike	SC.	Exhause Gas	Exhause Temp	Exhause Baro Pressure (mm HgO)	Relative Humidity (%)	Engage Speed (rev/min)	Load %	Calculated Power (kW)	Torque (Nm)	Fuel Consumption	Lubricating Oil			
1	2	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	6:00	40	41	300	660	--	76	3010	0.7	2.8	0.866	36	290	503	580	400	6.86			
2	7:00	298	301	303	661	--	75	3012	1.3	5.5	1.7333	36	275	530	306	500	6.5			
3	8:00	299	302	304	663	--	73	3008	2.0	8.3	2.600	40.5	260	561	216	550	6			
4	9:00	300	303	305	668	--	71	3009	2.6	11.0	3.466	40.5	200	729	210	560	5.6			
5	*****	300	303	306	670	--	68	3015	2.9	12.1	3.813	40.5	150	972	255	570	5.23			
6	11:00	300	304	307	673	--	65	3018	3.0	12.8	4.0400	40.5	140	1041	258	590	4.7			
7	*****	302	307	310	674	--	63	3014	3.5	14.8	4.666	40.5	130	1122	240	600	4.9			
8	1:00	305	308	311	677	--	61	3012	3.7	15.6	4.933	40.5	110	1325	269	610	4.8			
9	2:00	306	309	312	679	--	60	3010	3.8	16.1	5.066	40.5	103.5	1409	278	620	4.9			
10	3:00	307	310	313	683	--	62	3014	3.9	16.5	5.200	40.5	103.6	1407	271	63	4.8			
11	4:00	306	309	312	682	--	63	3020	4.0	16.9	5.333	40.5	98	1488	279	650	4.9			
12	5:00	304	307	310	680	--	63	3018	4.2	17.7	5.800	40.5	90	1620	289	660	4.8			
13	6:00	301	304	307	709	--	65	3015	4.4	18.6	5.866	40.5	88	1657	282	670	4.3			

CHAMP ENERGY VENTURES PVT. LTD..

PERFORMANCE CURVE OF CH196 ENGINE
(AS PER IS 10001 : 1982)

CHAMP ENERGY VENTURES PVT. LTD..

PERFORMANCE CURVE OF CH418 ENGINE
(AS PER IS 10001 : 1982)

WP 15-

WP 15 PUMP ENDURANCE TESTING

PUMP TEST RECORD SHEET											
Engine Details		Pump Details.									
Engine Model		CH196		Name /No.		Self Priming_ 3" x 3"				Date	
Engine No.										13.02.2018	
Type.		Air Cooled single Cyl. Petrol Engine		Rated Duty Point						Actual Duty Point :	
				Discharge (LPS):		11.5				Discharge	
										Head	
HP&Kw		5.0/3.7				Head (mtr):		22		Head	
SPEED(RPM)		3600				Rated Discharge Ran		05- 14 LPS			
FUEL TANK CAPACITY		2.5				Rated Head Range		09-22			
Efficiency								60 % (APPROX)			
SFC		262gm/hp-hr				PIPE SIZE (SUC)MM		80 mm			
						PIPE SIZE (DEL)MM		80 mm			
S.N o.	Discharge (Engine RPM)	Discharge (LPS)	Corrected Discharge at Rated Engine RPM	Suction Gauge Meter Reading	Delivery Gauge Meter	Center Distance Between Pump Suction Pipe to Delivery	Velocity Correcton (Mtr)	Total Head	Corrected Head at rated RPM	Time in Second	Fuel Consumption (g/hr)
1	3626	0	0.0	0.4	25	1.03	0.13	26.55	26.2	230	653.5
2	3609	100	1.7	0.6	22	1.03	0.13	23.76	23.6	212	709.0
3	3607	200	3.3	0.8	19	1.03	0.13	20.96	20.9	205	733.2
4	3601	300	5.0	0.8	17.5	1.03	0.13	19.46	19.4	197	762.9
5	3596	400	6.7	1	16	1.03	0.13	18.16	18.2	175	858.9
6	3603	500	8.3	1.1	13.8	1.03	0.13	16.06	16.0	165	910.9
7	3602	600	10.0	1.6	10	1.03	0.13	12.76	12.7	160	939.4
8	3606	750	12.5	1.8	6.3	1.03	0.13	9.86	9.8	145	1036.6
9	3600	850	14.2	1.9	4	1.03	0.13	7.06	7.1	130	1156.2
10	3605	980	16.3	2	2	1.03	0.13	5.16	5.1	115	1307.0
Fuel Consumption (g/hr)											
<p>This graph plots Fuel Consumption (g/hr) on the Y-axis (0.0 to 1400.0) against Discharge (LPS) on the X-axis (0.0 to 20.0). The curve shows an increasing trend of fuel consumption with discharge. Data points are plotted at various discharge levels, showing a general upward slope.</p>											
Corrected Discharge-Head at rated RPM											
<p>This graph plots Total Head (mtr) on the Y-axis (0.0 to 30.0) against Discharge (LPS) on the X-axis (0.0 to 20.0). The curve shows a decreasing trend of total head with discharge. A vertical line marks the rated discharge of 14.2 L/s, and a horizontal line marks the rated head of 14.2 mtr. Data points are plotted at various discharge levels, showing a general downward slope.</p>											
Pump Certified for:											
a) Total Head in mtr. : _____ b) Discharge in L/s : _____ c) Fuel Consumption in g/hr. : _____											
Rev / min. : _____ Set Started at: _____ Set stopped at: _____											
General requirements : Satisfactory / unsatisfactory Remarks : _____											



Enriching Lives

QUALITY ASSURANCE
KOEL PUNE411003

FAILURE ANALYSIS REPORT

From: Quality Assurance

Ref: QAME/14-15

To: Customer Support

Date: 23/01/2018

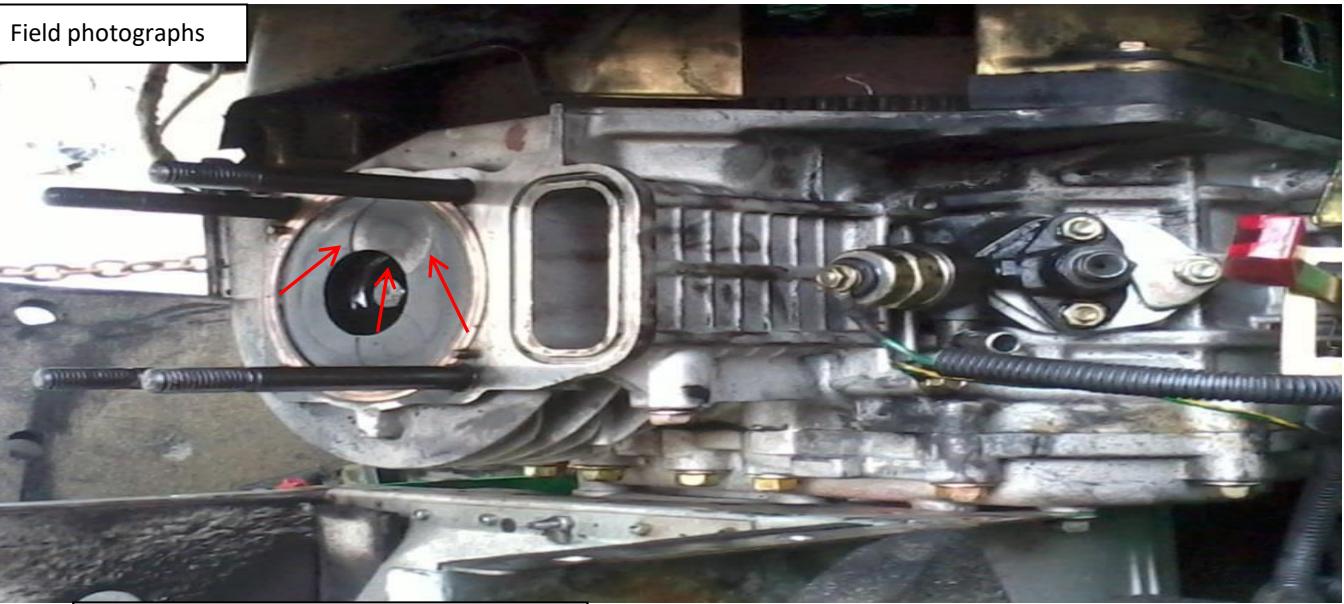
Subject	: Field complaint
Reference	: Servicing
Complaint	: Engine not starting
Engine Type	: CH 196
Engine sr. no.	: Disclosed for
Privacy.	
Engine Application	: Power Generator
Hrs. run	: 340 hrs.
Material Received	: All parts.
Dealers	: Gangpur Sales and services

Engine history-

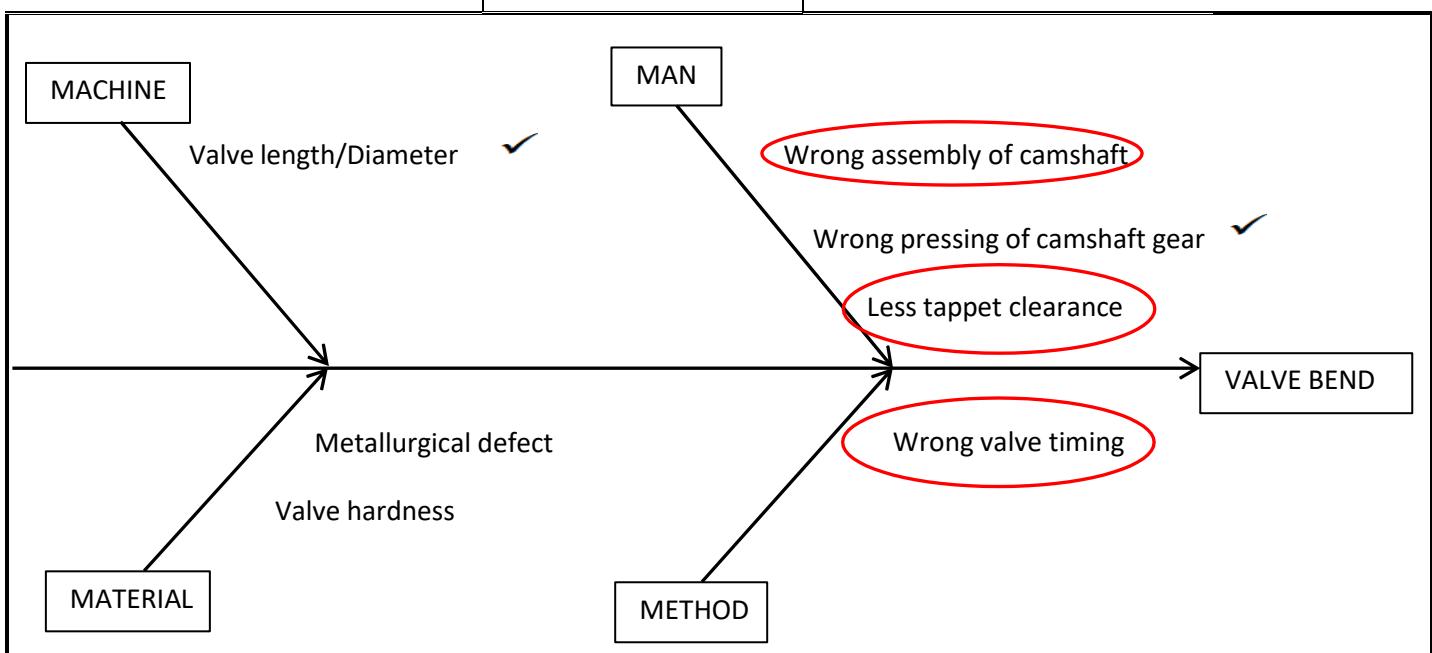
C1- Oil change- 50 hours
C2- Oil change- 250 hours

Field Complaint-

Engine not starting, abnormal noise coming from engine at the time of cranking



FISH BONE DIAGRAM



✓
Checked found ok
Root cause

Observations on engine-

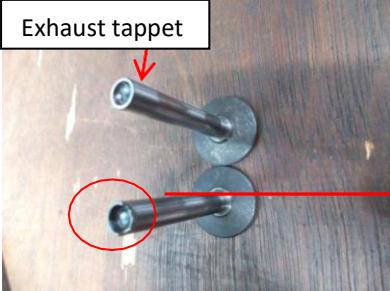
Intake valve observed in bend condition		
Valve springs, Collets and its cup checked- No abnormality observed		

No abnormality in push rod and rocker lever

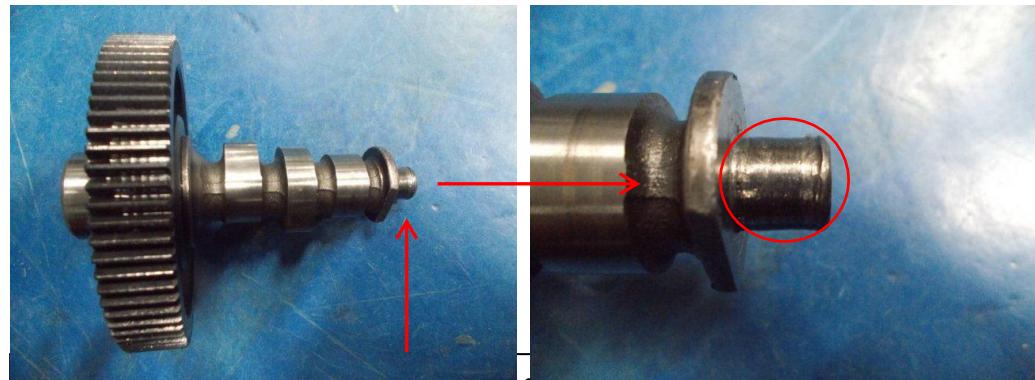


Sub sequential failure-

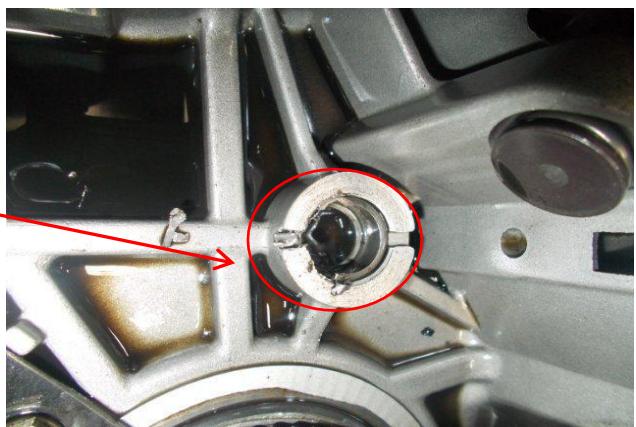
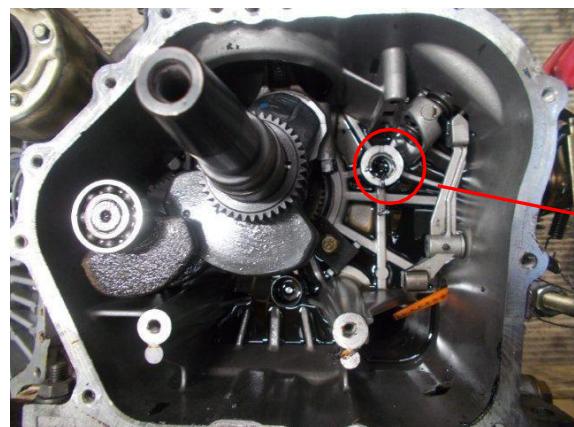
Inlet valve tappet- Push rod mounting cavity observed in damaged condition (Secondary failure)



Observations on camshaft-



Camshaft needle bearing mounting diameter observed in seize condition- Secondary failure



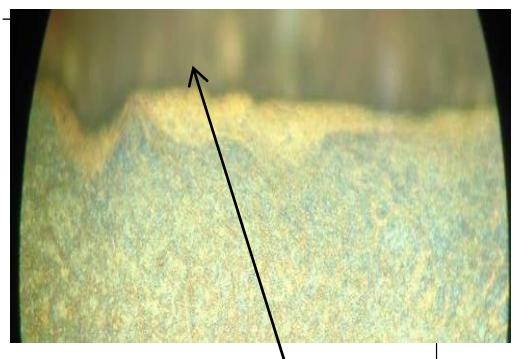
Camshaft mounting needle bearing observed in damaged condition- Secondary failure

**Kirloskar Oil Engines
Ltd.,
Medium Engine, Pune.**

**Standard Room & Metallurgy Laboratory
Metallurgical Inspection Report**



Date	25.02.2018	Lab Report No. GRR /	Feb//25/14/2018	
Part Name	Camshaft	Challan No.	---	
Part No.	Not known	Lot Qty.	---	
Supplier	Not known	Sample Qty. Requested	02 no	
Testing For	Metallurgical Evaluation	Warranty QA By:		
Reference	Camshaft removed from engine due to wear at needle brg mounting area on engine no. CC1.9001/13020217			
Sr. No.	Parameter	Specification	Observations	
1	Chemical Composition		Sample A Sample B	
		C %	--- 0.45	0.43
		Mn %	--- 0.65	0.63
		Si %	--- 0.2	0.21
		S %	--- 0.006	0.008
2	Microstructure	P %	--- 0.014	
		Cr %	--- 0.013	0.03
		Case	--- Tempered martensite	
3	Induction	Core	Ferrite and pearlite uniformly (Normalized structure)	
		Case Depth	--- 1.9 mm	2.23 mm
		Case Length	--- 10.6 mm	11.2 mm
		hardening profile	Surface hardness	48 - 50 HRC
4	Induction hardening Traverse graph	Core Hardness	184-192 HV1	
		0	0	220-241 HV1
		100	100	
		200	200	
		300	300	
400	400			
500	500			
600	600			
700	700			
800	800			
900	900			
1000	1000			

			
	Quench crack of 0.7 mm observed in Sample B. Location top surface	Material flow is observed at surface	
Comments			
<ul style="list-style-type: none"> - 1. Camshaft is manufactured from CK45 grade & induction hardened. 2. At needle bearing mounting area, sample A shows drop in case hardness. This is due to heat generated due to metal-to-metal contact during running. This may be due to insufficient lubrication 3. Sample B shows proper induction hardening pattern (case depth, case hardness & microstructure) barring the quench crack. 			

Conclusion:

- **Suspected cause (Non-conclusive): Valve timing and tappet setting (Tappet clearance cannot be confirmed because of engine received in dismantle condition)**

Corrective Action if any:

1. Check list preparation by QA to be circulated to CS for confirmation and checking to be done at site during dismantling.
2. Information to be given to Assembly Plant (M/s Champ)
3. Audit to be performed for assembly at M/s Champ

QUALITY ASSURANCE

CC: s 1) Production 2) QAC – ME
 3) Materials 4) RQA



Enriching Lives

QUALITY ASSURANCE
KOEL PUNE411003

FAILURE ANALYSIS REPORT

From: Quality Assurance

Ref: Disclosed

To: Customer Support

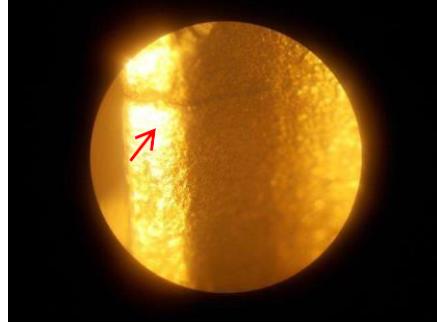
Date: 26/11/2017

Subject	: Field complaint
Reference	: Servicing
Complaint	: Abnormal noise from engine
Engine Type	: CC
Engine sr. no.	: Disclosed.
Engine Application	: Power Generator
Hrs. run	: 32 hrs.
Material Received	: All parts.
Dealers	: Johnsons power solution

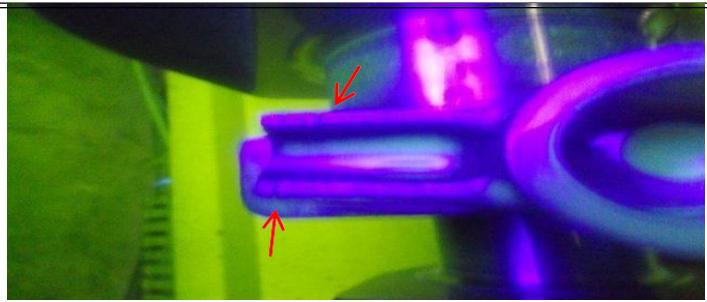
Engine history-

Engine block burst due to striking of connecting rod and Lub oil leakage- 32 hours

Observations-

Connecting rod broken from i-section	
Failed connecting rod- Initial crack observed on connecting rod i-section	 

Magnetic particle inspection carried out on failed connecting rod- Cracks found on con rod i-section



Sub- sequent failure because of con rod breakage-

Piston observed in at gudgeon pin mounting area



No abnormality observed in crankshaft and connecting rod bearing



Connecting rod metallurgy report-

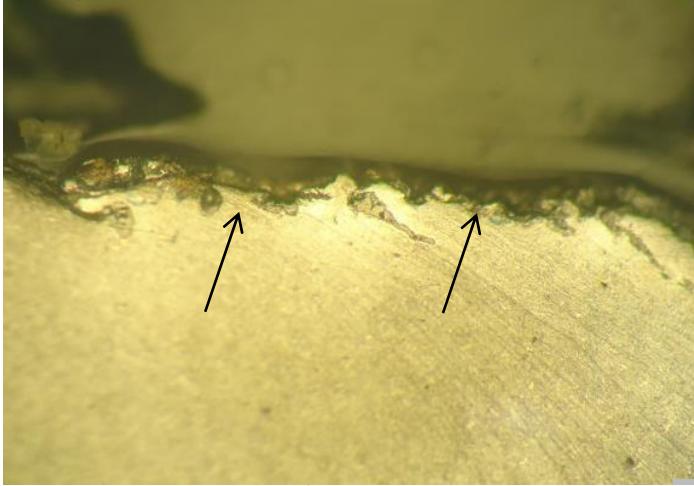
**Kirloskar Oil
Engines Ltd.,
Medium Engine,
Pune.**

**Standard Room & Metallurgy
Laboratory
Metallurgical Inspection Report**



Enriching Lives

Date	26.12.17	Lab Report No.	DEC/26/14/003
Part Name	Connecting Rod	GRR / Challan No.	---
Part No.	Not known	Lot Qty.	---
Supplier	Not known	Sample Qty.	01 no
Testing For	Metallurgical Evaluation	Requested By:	Warranty QA
Reference	Breakage of con rod at 'I' section on engine no. CC1.9001/13050020		
Sr. No.	Parameter	Specification	Observations
1	Chemistry		

	C %	---	0.38	39 Cr 5 / equivalent grade	
	Si %	---	0.16		
	Mn %	---	0.77		
	S %	---	0.01		
	P %	---	0.018		
	Cr %	---	0.89		
	Mo %	---	0.007		
2	Hardness				
		---	255 BHN		---
3	Microstructure				
		---	Tempered martensite all over matrix. This indicates that con rod is in hardened & tempered condition		---
4	Forging Defect				
	Lap type forging defect are observed on con rod 'I' section on side face.				
	 Image 1				Not acceptable

Comments

1. Material used, heat treatment, hardness and microstructure of con rod is satisfactory.
2. Forging defects observed on con rod 'I' section are not at all acceptable as it will lead to premature breakage.

Disclosed
Metallurgist

Conclusion:

Forging lap like defects (Cracks) are observed on con rod I-section

Corrective Action if any:

Con rod forging process needs to be improved to eliminate forging laps

QUALITY ASSURANCE

CC: s 1) Production 2) QAC – ME
 3) Materials 4) RQA