

KUBOTA ENGINES

APPLICATION MANUAL
(WG752, WG972 E3 MODEL)
(DG972 E2 MODEL)

First Edition

January, 2011

KUBOTA

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1. PREFACE

1. This has been prepared so as to enable users to properly and efficiently utilize KUBOTA small SI engines.
2. This manual describes the features of the engines, the cautions and the check items for mounting the engines on various machines.
3. The contents of this manual are roughly divided into the following two items.
 - a) General information
 - b) Technical information
4. This manual describes only the content that should be mentioned specially for small SI engines. Please also refer to the diesel engine application manual.
5. Phase3 emissions regulations require confirmation of “Emissions-Related Installation Instructions”, “Contractual agreement” etc. between engine and equipment manufactures under 40CFR1068.
6. The specifications and features described in this manual are subject to change without advance notice for technical improvement.
7. If you have any question about this manual, please contact with nearest KUBOTA sales representatives or send e-mail to [“k-iss@kubota.co.jp”](mailto:k-iss@kubota.co.jp).

2 GENERAL INFORMATION

0. GENERAL

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1. SPECIFICATIONS

Item		Model	WG752-G-E3	WG752-GL-E3
Type			Vertical, water cooled 4-cycle Gasoline engine	Vertical, water cooled 4-cycle Dual Fuel (Gasoline/LPG)
				Gasoline fuel LPG fuel
Number of cylinders			3	
Cylinder bore x Stroke		mm (in)	68.0 (2.68) x 68.0 (2.68)	
Total displacement		L (cu. in)	0.740 (45.2)	
High idle		min ⁻¹ (rpm)	3850	
Low idle		min ⁻¹ (rpm)	1500	
Brake horse power	SAE J1995 Gross intermittent	kW (HP) / min ⁻¹ (rpm)	18.5 (24.8) / 3600	17.7 (23.8) / 3600
	SAE J1349 Net intermittent		17.1 (23.0) / 3600	16.4 (22.0) / 3600
	SAE J1349 Net continuous		13.4 (18.0) / 3600	12.7 (17.0) / 3600
	ISO Gross		18.5 (24.8) / 3600	17.7 (23.8) / 3600
	ISO Continuous		13.4 (18.0) / 3600	12.7 (17.0) / 3600
	JIS B8002 Net Intermittent		17.1 (23.0) / 3600	16.4 (22.0) / 3600
	JIS B8002 Continuous		13.4 (18.0) / 3600	12.7 (17.0) / 3600
Max. torque (SAE J1349)		N·m (ft·lb) min ⁻¹ (rpm)	54.9 (40.5) / 2400	52.0 (38.3) / 2400
Compression ratio			9.2	
Firing order			1-2-3	
Ignition timing			B.T.D.C.18 °	
Fuel			Unleaded gasoline	Commercial LPG *
Direction of rotation			Counter-clockwise from flywheel side	
Starting system			Electric starting with cell starter	
Starter output		V-kW	12-0.7	
Alternator output		V-W	12-150 (Standard)	
Lubricating system			Forced lubricating by trochoid pump	
Lubricating oil			Quality better than SH class	
Lubricating oil capacity		L (U.S. gal)	3.25 (0.86)	
Catalytic Muffler / Converter			Three Way Catalyst	
Coolant capacity (with radiator)		L (U.S. gal)	2.8 (0.74)	
Governor type			Centrifugal ball mechanical type governor	
Dimensions (L x B x H)		mm (in)	428.5 x 396.9 x 539.8 (16.87 x 15.63 x 21.25)	
Dry weight		kg (lb)	Approx. 61.7 (136.0)	

■ **NOTE**

- * LPG regulator with vaporizer operates on a liquid withdrawal type system.

Item		Model	WG972-G-E3	WG972-GL-E3
Type			Vertical, water cooled 4-cycle Gasoline engine	Vertical, water cooled 4-cycle Dual Fuel (Gasoline/LPG)
				Gasoline fuel
Number of cylinders			3	
Cylinder bore x Stroke		mm (in)	74.5 (2.93) x 73.6 (2.90)	
Total displacement		L (cu. in)	0.962 (58.7)	
High idle		min ⁻¹ (rpm)	3850	
Low idle		min ⁻¹ (rpm)	1500	
Brake horse power	SAE J1995 Gross intermittent	kW (HP) / min ⁻¹ (rpm)	24.2 (32.5) / 3600	23.1 (31.0) / 3600
	SAE J1349 Net intermittent		23.1 (31.0) / 3600	22.0 (29.5) / 3600
	SAE J1349 Net continuous		18.7 (25.0) / 3600	17.5 (23.5) / 3600
	ISO Gross		24.2 (32.5) / 3600	23.1 (31.0) / 3600
	ISO Continuous		18.7 (25.0) / 3600	17.5 (23.5) / 3600
	JIS B8002 Net Intermittent		23.1 (31.0) / 3600	22.0 (29.5) / 3600
	JIS B8002 Continuous		18.7 (25.0) / 3600	17.5 (23.5) / 3600
Max. torque (SAE J1349)		N·m (ft-lb) min ⁻¹ (rpm)	68.6 (50.6) / 2400	64.6 (47.6) / 2400
Compression ratio			9.2	
Firing order			1-2-3	
Ignition timing			B.T.D.C. 8 ° / 1000 min ⁻¹ (rpm) B.T.D.C. 21 ° / 3600 min ⁻¹ (rpm) *1	
Ignition system			Distributor-less Solid State type	
Fuel			Unleaded gasoline	Commercial LPG *2
Direction of rotation			Counter-clockwise from flywheel side	
Starting system			Electric starting with cell starter	
Starter output		V-kW	12-1.0	
Alternator output		V-W	12-480 (Standard)	
Lubricating system			Forced lubricating by trochoid pump	
Lubricating oil			Quality better than SH class	
Lubricating oil capacity		L (U.S. gal)	3.4 (0.90)	
Catalytic Muffler / Converter			Three Way Catalyst	
Coolant capacity (with radiator)		L (U.S. gal)	3.5 (0.92)	
Governor type			Centrifugal ball mechanical type governor	
Dimensions (L x B x H)		mm (in)	BBH : 452.6 x 416.4 x 502.5 (17.82 x 16.39 x 19.78) SAEH : 525.5 x 416.4 x 502.5 (20.69 x 16.39 x 19.78)	
Dry weight		kg (lb)	Approx. 72.0 (159)	

■ NOTE

- *1 Consult Kubota for further information.
- *2 LPG regulator with vaporizer operates on a liquid withdrawal type system.

Item		Model	DG972
Type			Vertical, water cooled 4-cycle Natural Gas engine
Number of cylinders			3
Cylinder bore x Stroke		mm (in)	74.5 (2.93) x 73.6 (2.90)
Total displacement		L (cu. in)	0.962 (58.7)
High idle		min ⁻¹ (rpm)	3850
Low idle		min ⁻¹ (rpm)	1500
Brake horse power	SAE J1995 Gross intermittent	kW (HP) / min ⁻¹ (rpm)	18.7 (25.1) / 3600 *2
	SAE J1349 Net intermittent		17.6 (23.6) / 3600 *2
	SAE J1349 Net continuous		14.5 (19.4) / 3600 *2
	ISO Gross		18.7 (25.1) / 3600 *2
	ISO Continuous		14.5 (19.4) / 3600 *2
	JIS B8002 Net Intermittent		17.6 (23.6) / 3600 *2
	JIS B8002 Continuous		14.5 (19.4) / 3600 *2
Max. torque (SAE J1349)		N·m (ft·lb) min ⁻¹ (rpm)	55.0 (40.5) / 2400 *2
Compression ratio			9.2
Firing order			1-2-3
Ignition timing			B.T.D.C. 15 ° / 1000 min ⁻¹ (rpm) B.T.D.C. 28 ° / 3600 min ⁻¹ (rpm) *1
Ignition system			Distributor-less Solid State type
Fuel			Natural Gas only *2
Direction of rotation			Counter-clockwise from flywheel side
Starting system			Electric starting with cell starter
Starter output		V-kW	12-1.0
Alternator output		V-W	12-480 (Standard)
Lubricating system			Forced lubricating by trochoid pump
Lubricating oil			Quality better than SH class
Lubricating oil capacity		L (U.S. gal)	3.4 (0.90)
Coolant capacity (with radiator)		L (U.S. gal)	3.5 (0.92)
Governor type			Centrifugal ball mechanical type governor
Dimensions (L x B x H)		mm (in)	BBH : 452.5 x 415.4 x 502.53 (17.81 x 16.35 x 19.78) SAEH : 525.5 x 415.4 x 502.53 (20.69 x 16.35 x 19.78)
Dry weight		kg (lb)	BBH : Approx. 72.0 (159) SAEH : Approx. 95.4 (210)

■ **NOTE**

- *1 Consult Kubota for further information.
- *2 With Japanese standard natural gas.
The lower heating value : 9699kcal/m³ (1090BTU/ft³).

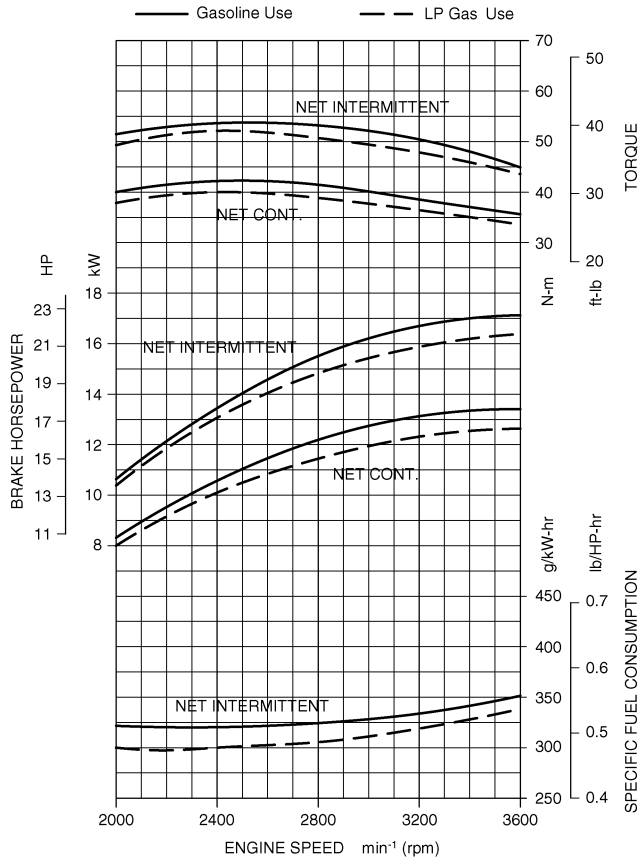


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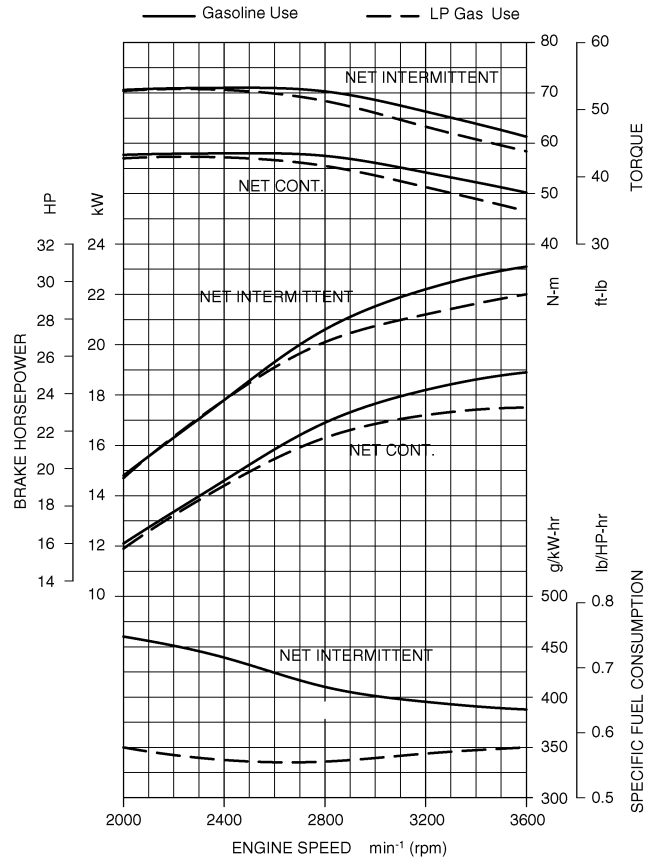
- This engine is only for stationary use. e.g. oil field and emergency generator.
- The brake horse power is limited under 19kW for emission regulations.

2. PERFORMANCE CURVES

WG752-G/GL



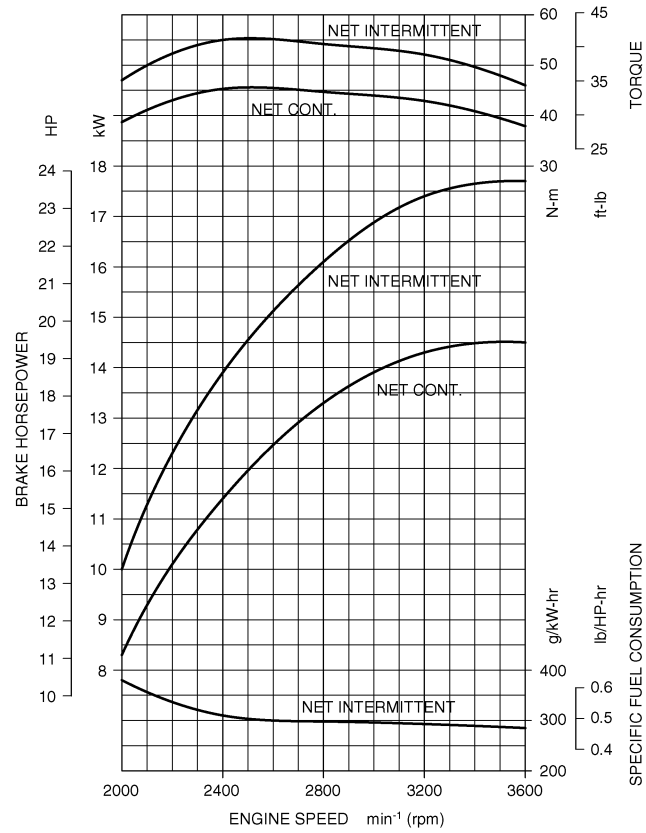
WG972-G/GL



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DG972

with Japanese standard natural gas : The lower heating value : 9699 kcal/m³ (1090 BTU/ft³)
The brake horse power is limited under 19 kW for emission regulations.

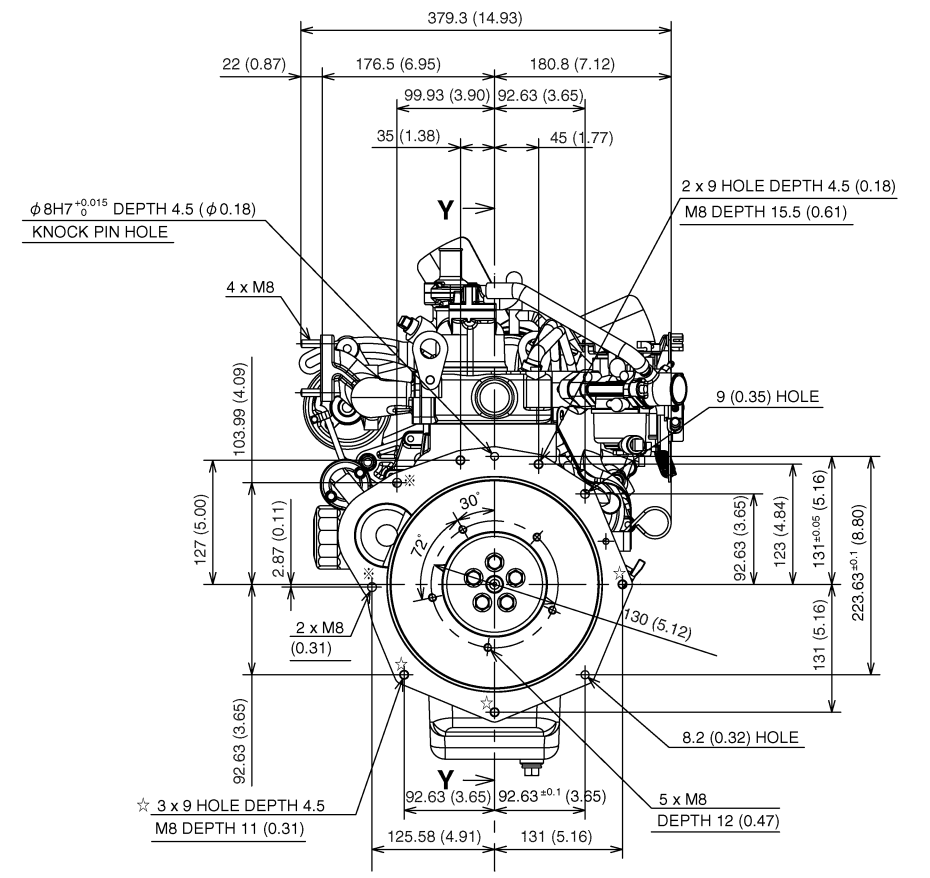
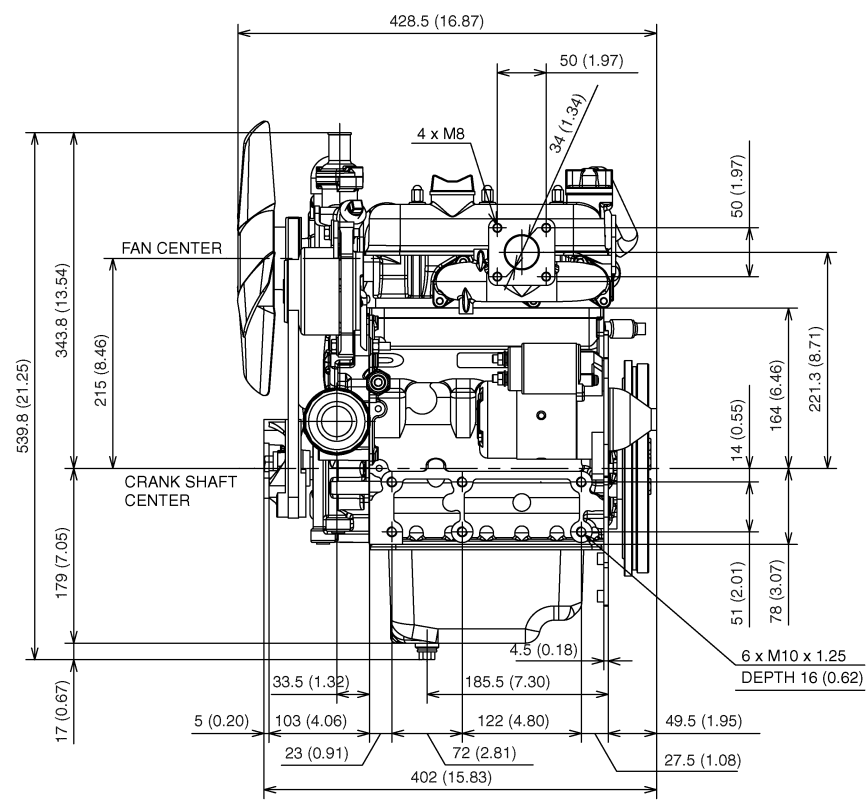
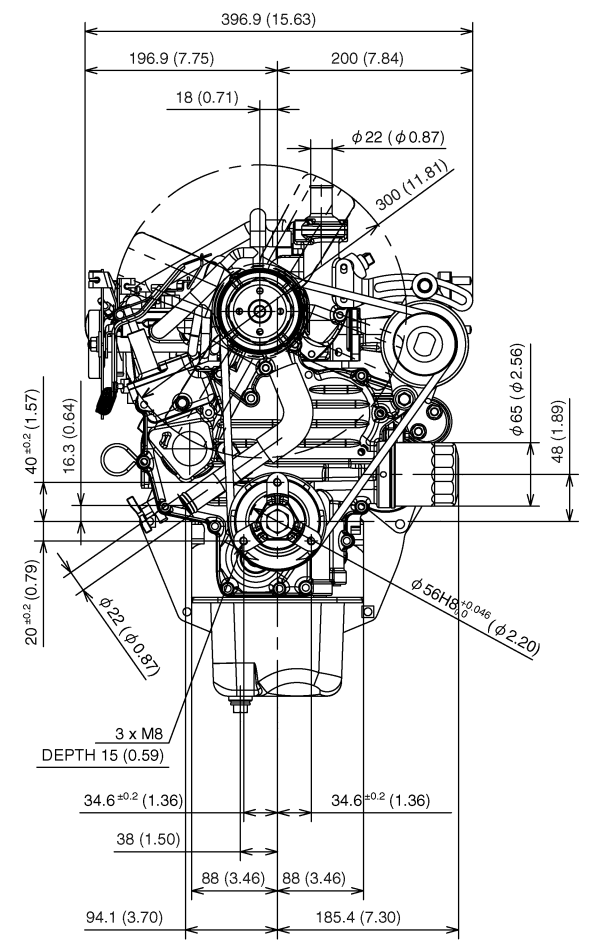
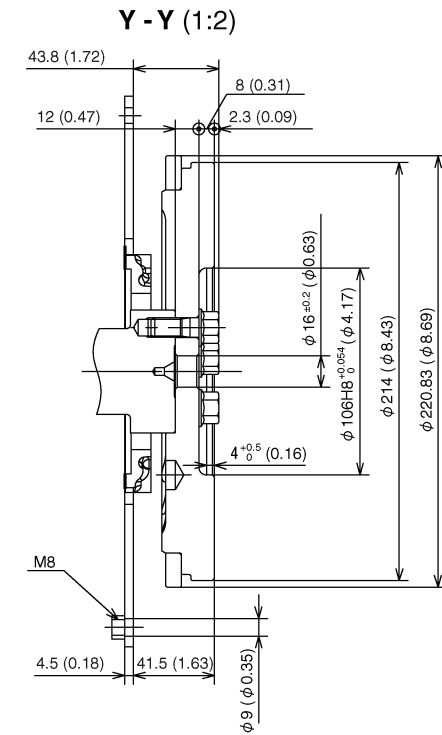
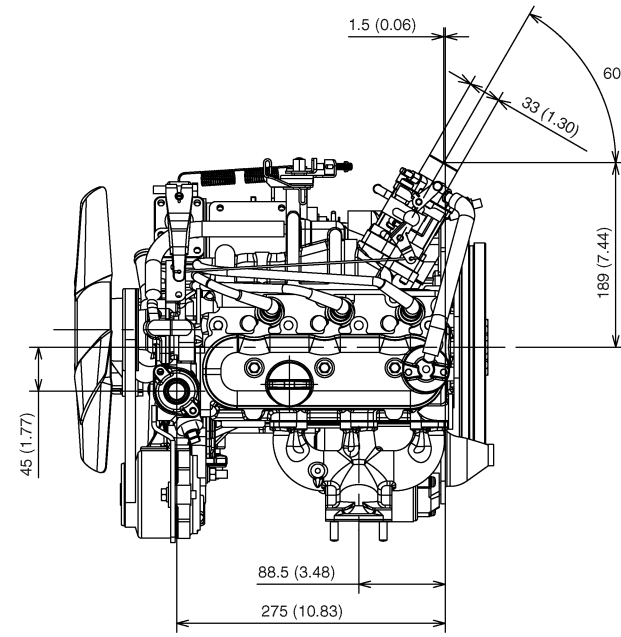
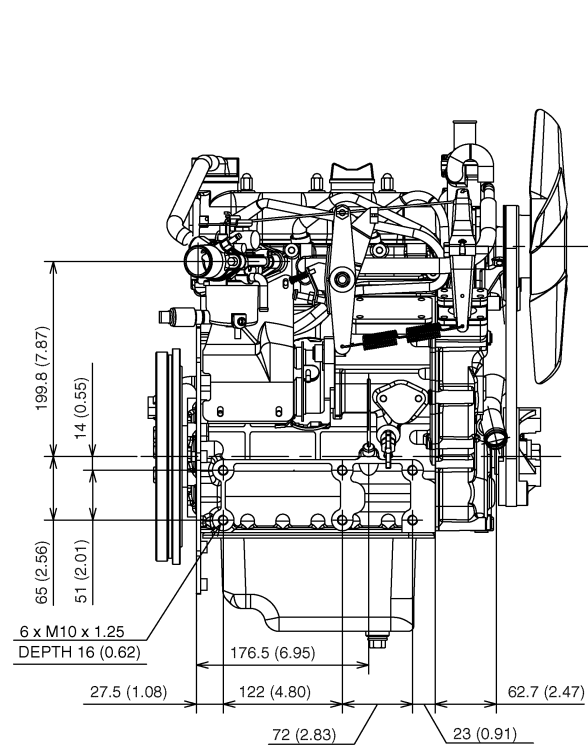


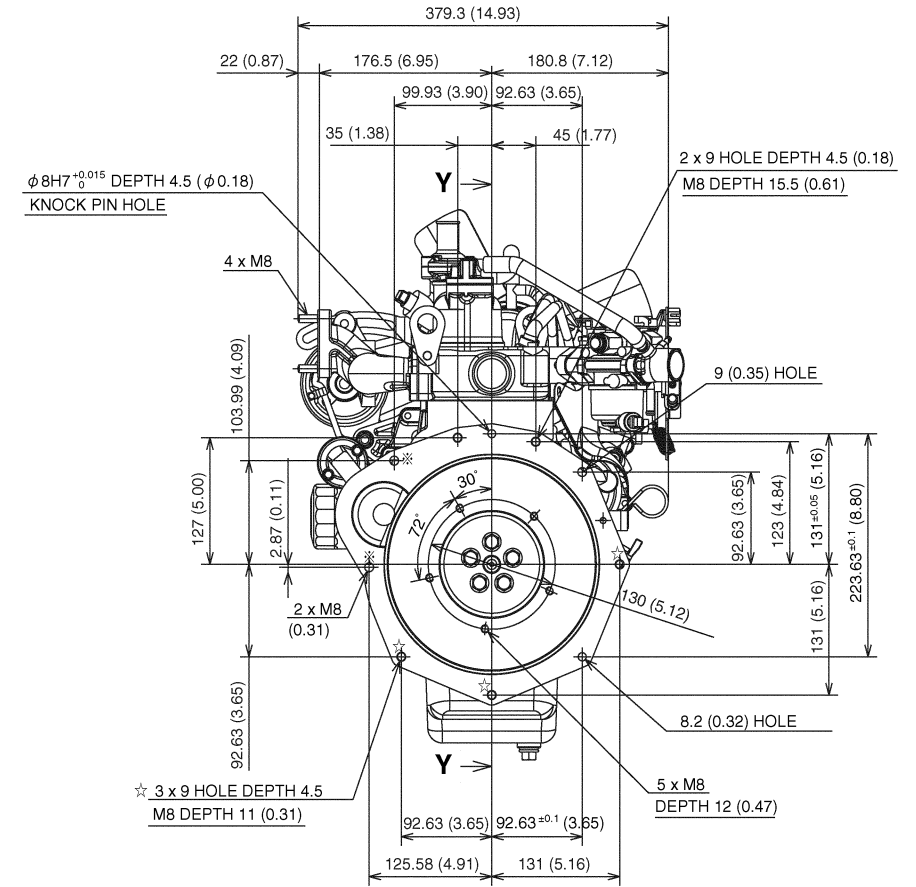
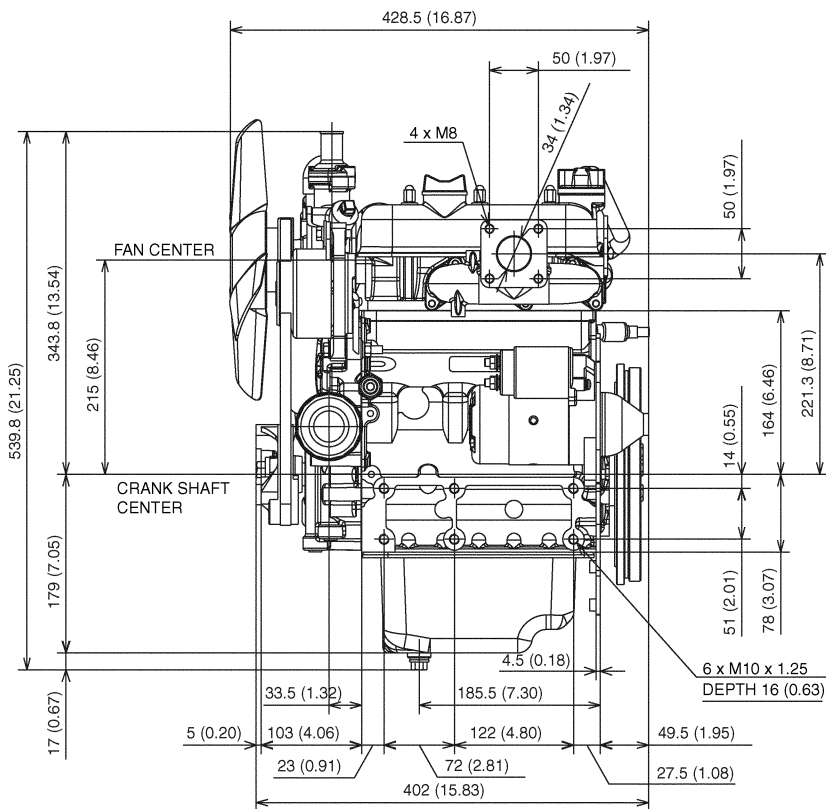
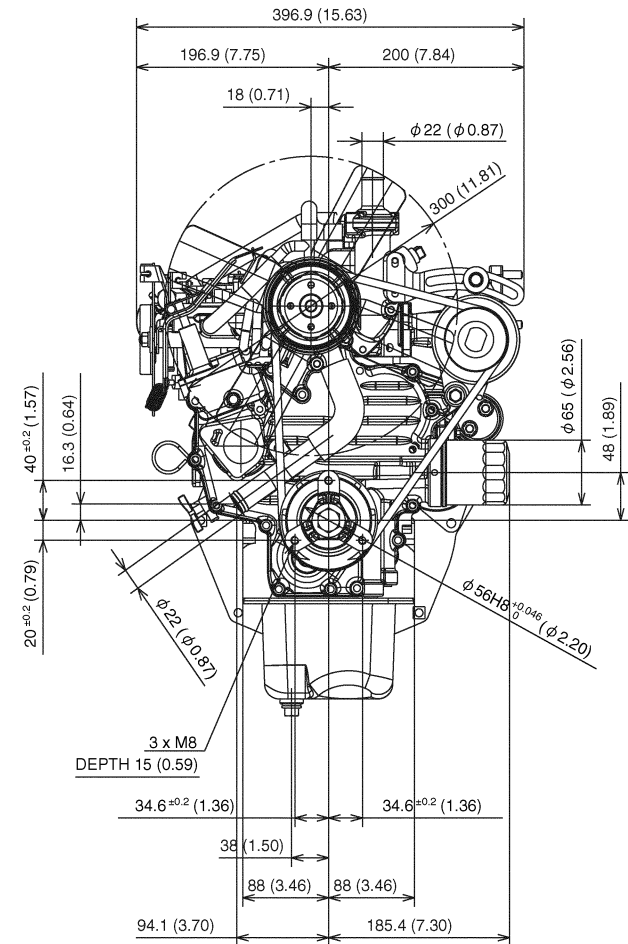
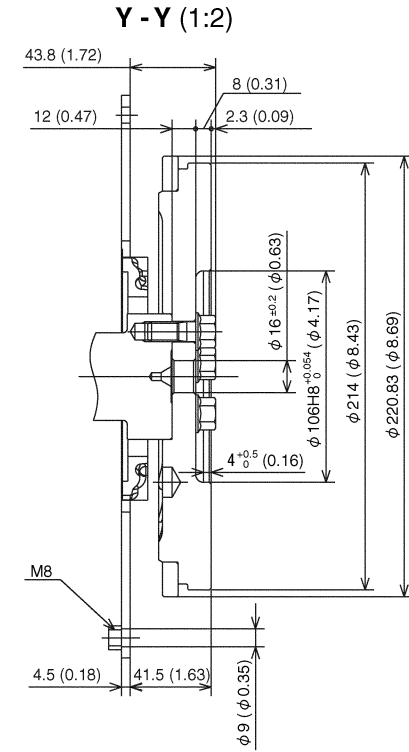
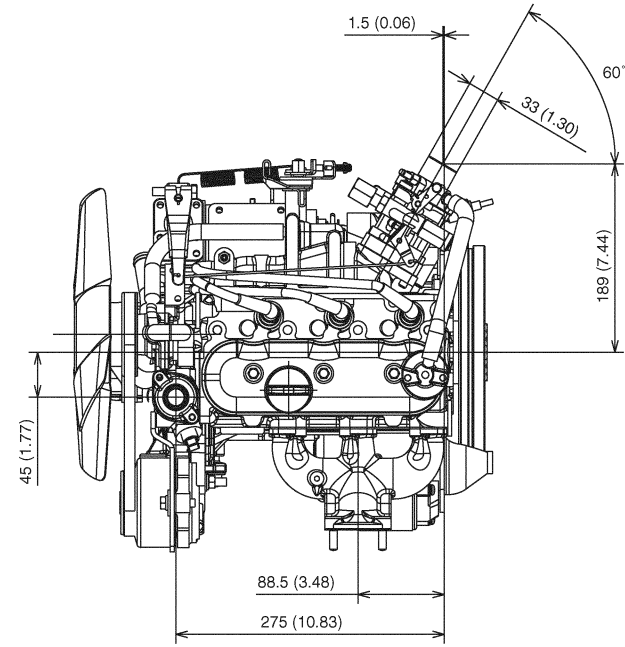
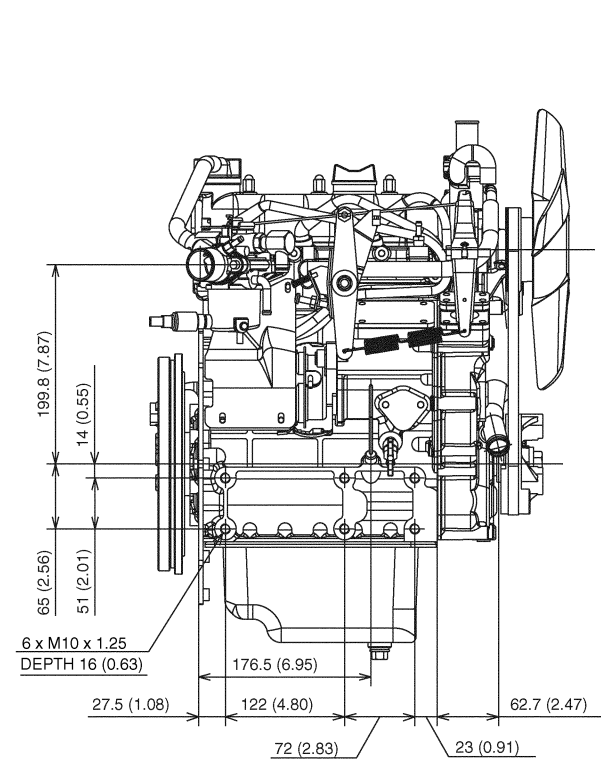
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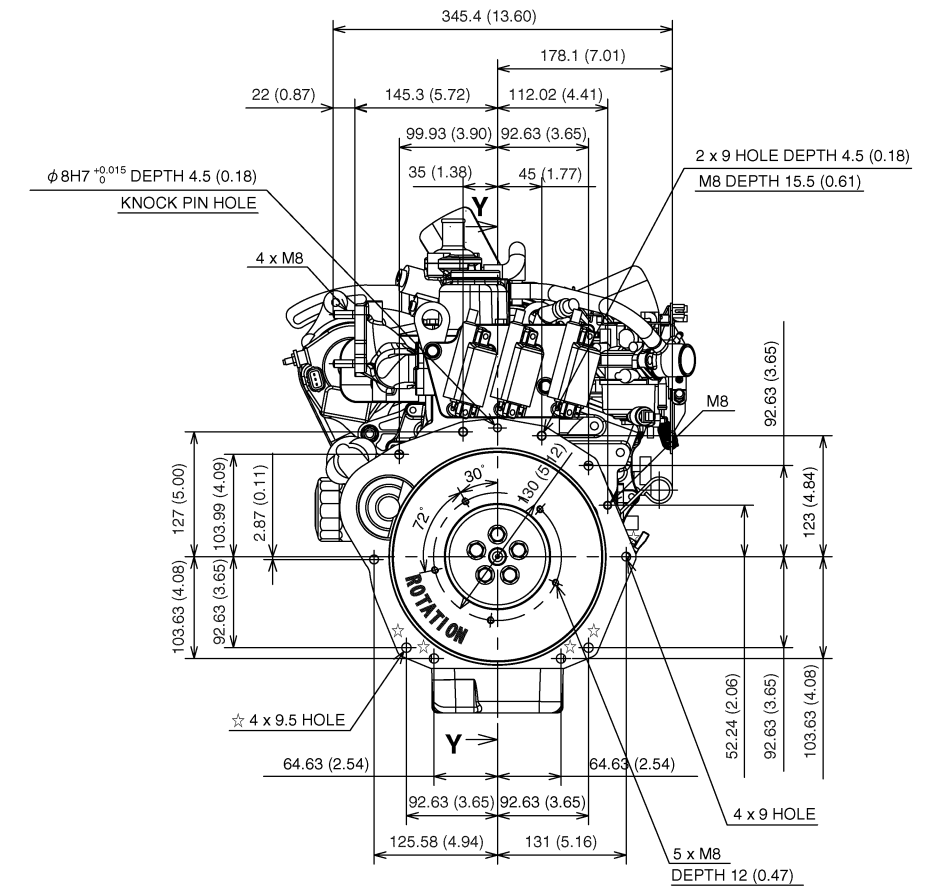
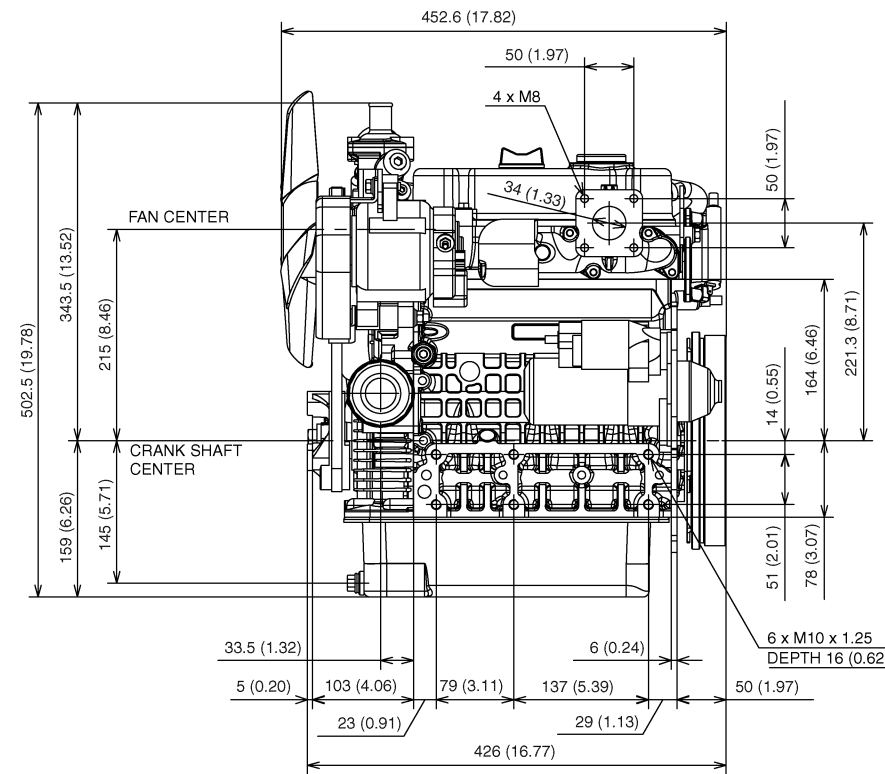
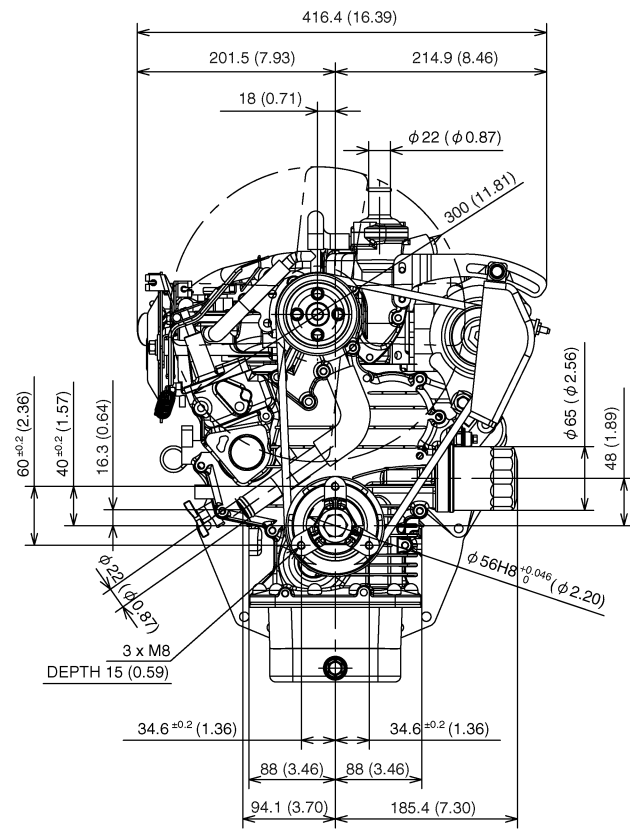
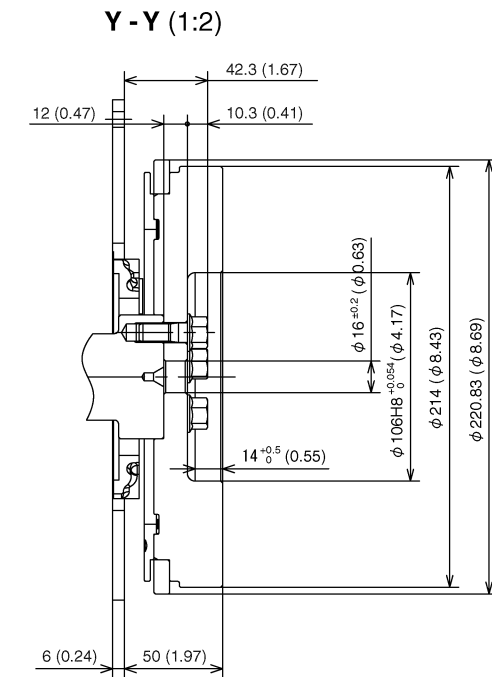
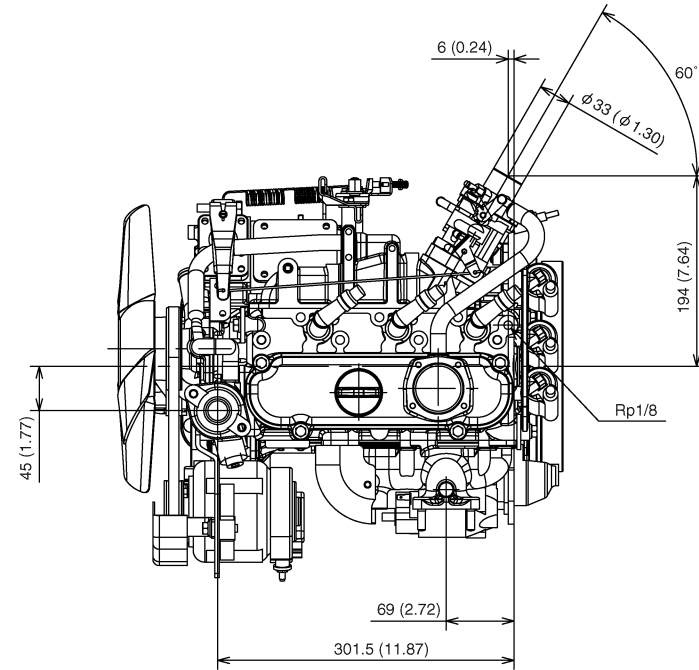
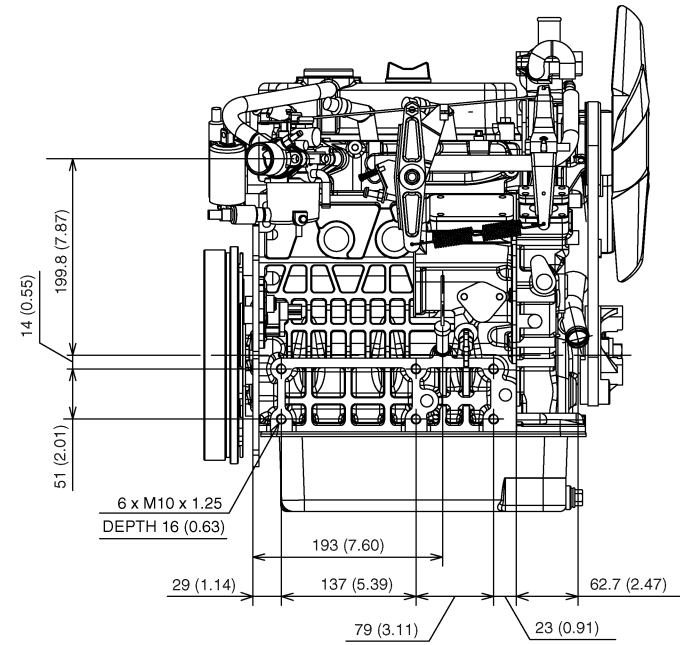
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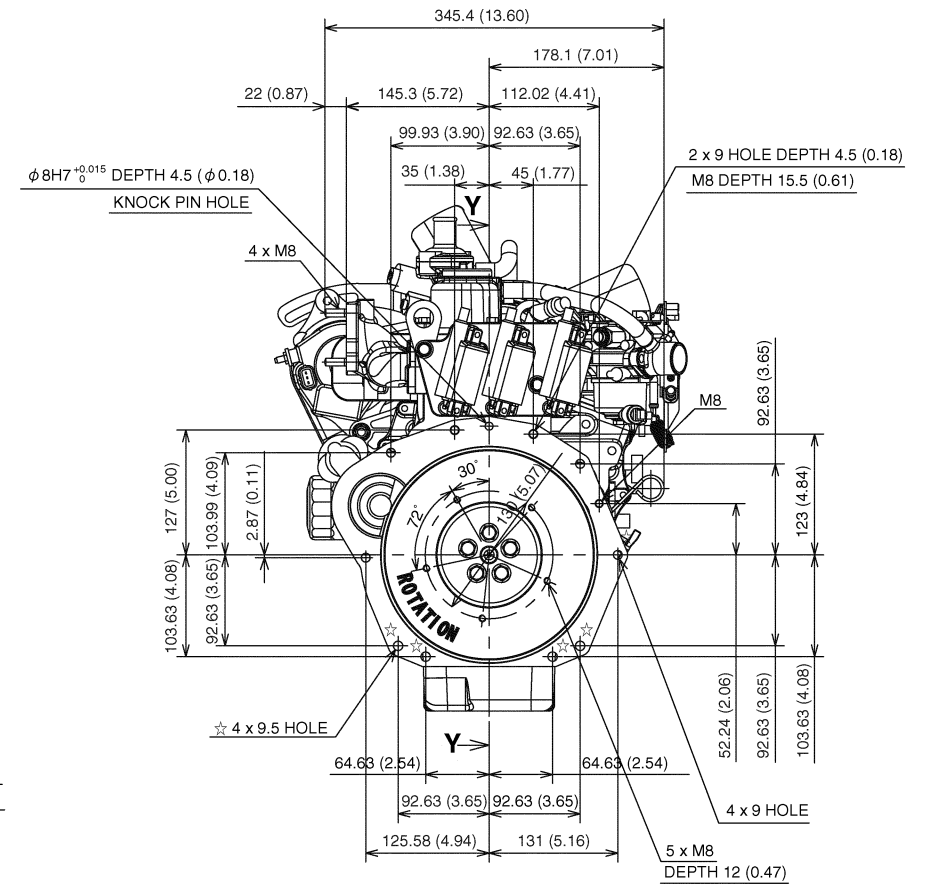
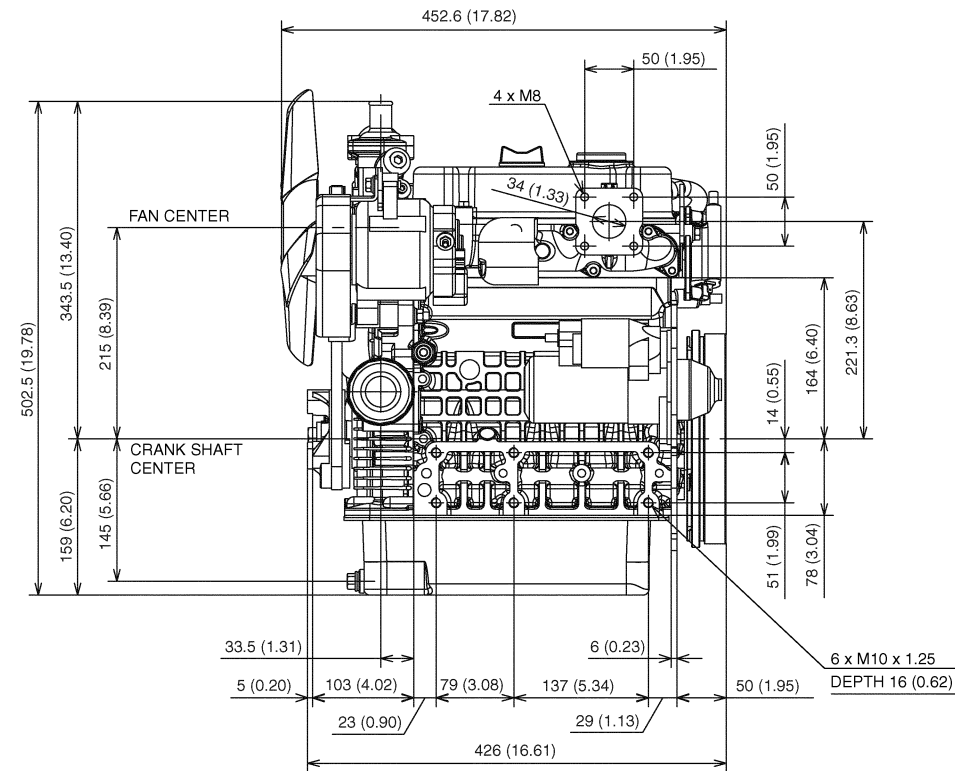
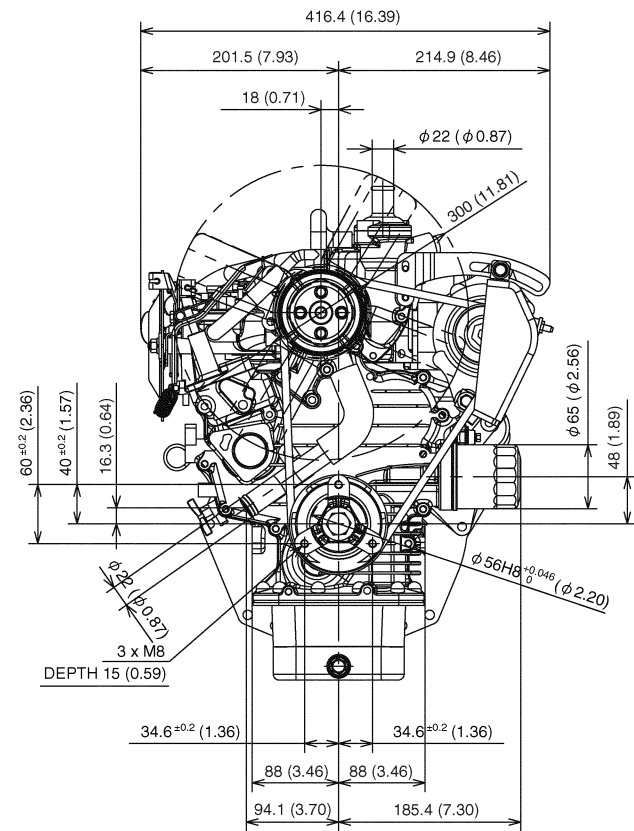
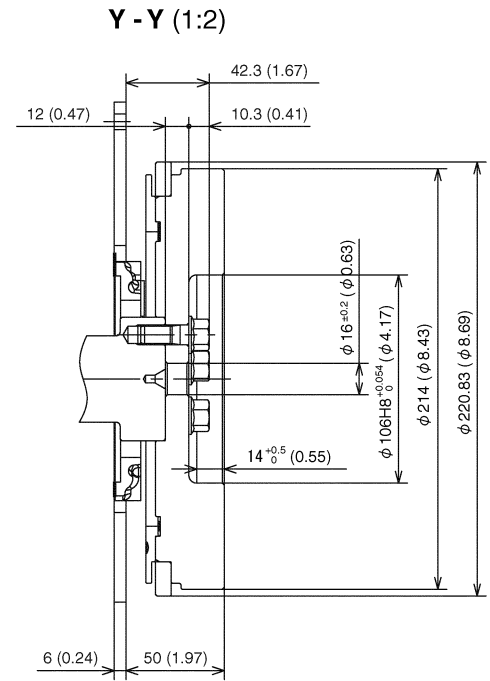
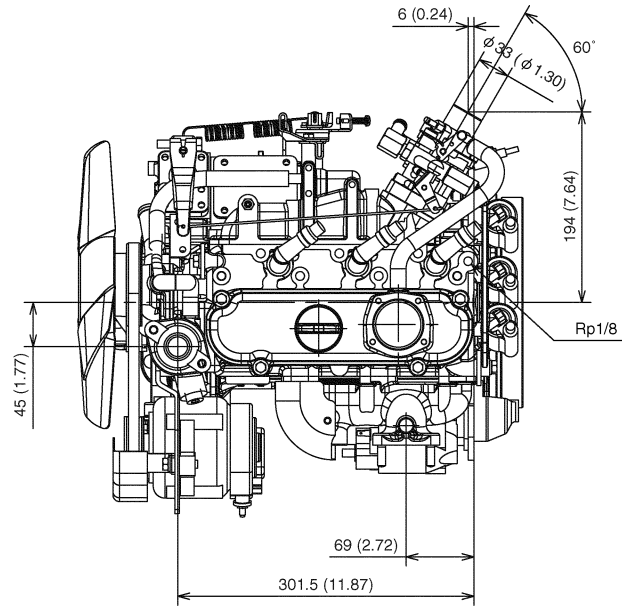
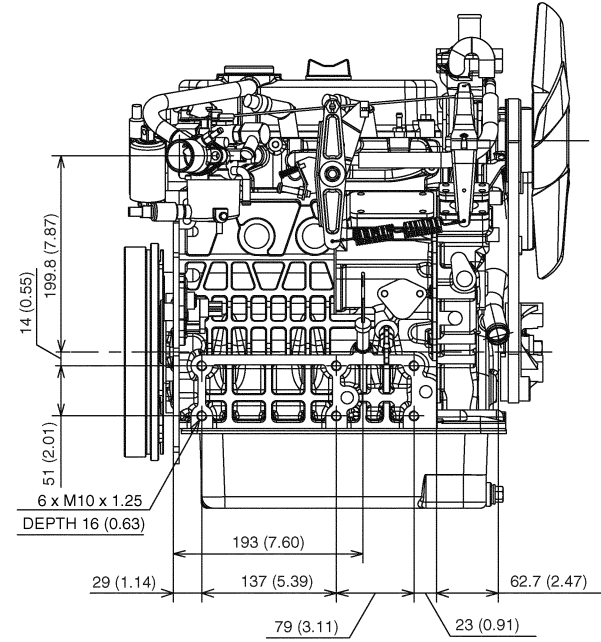
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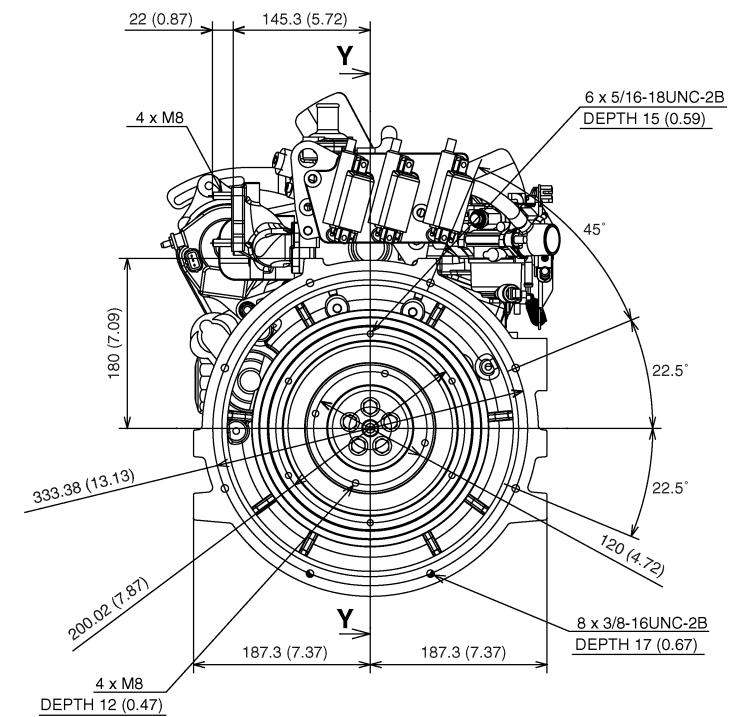
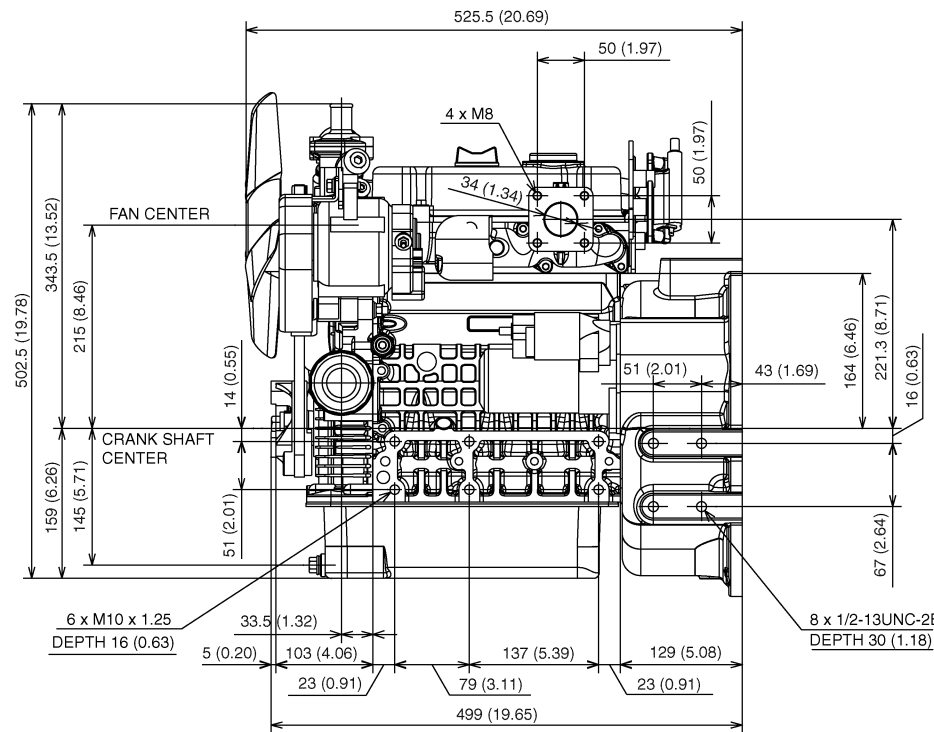
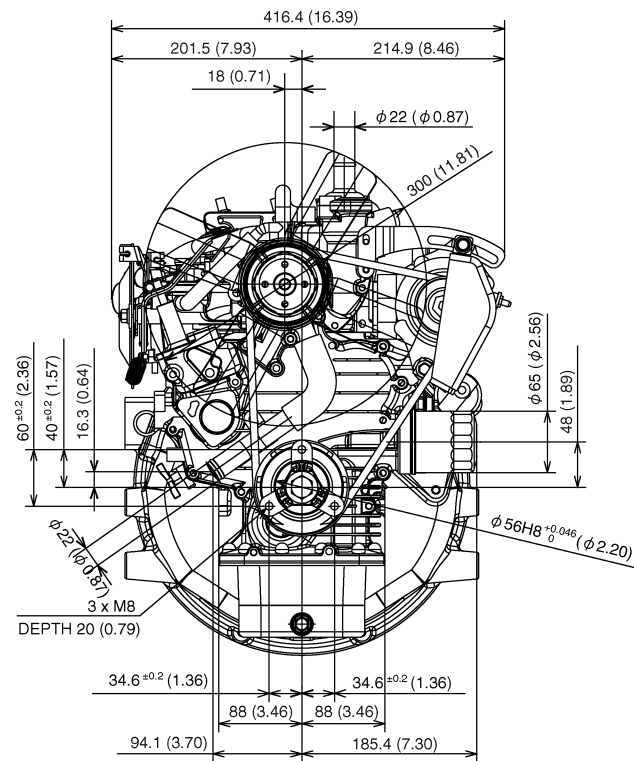
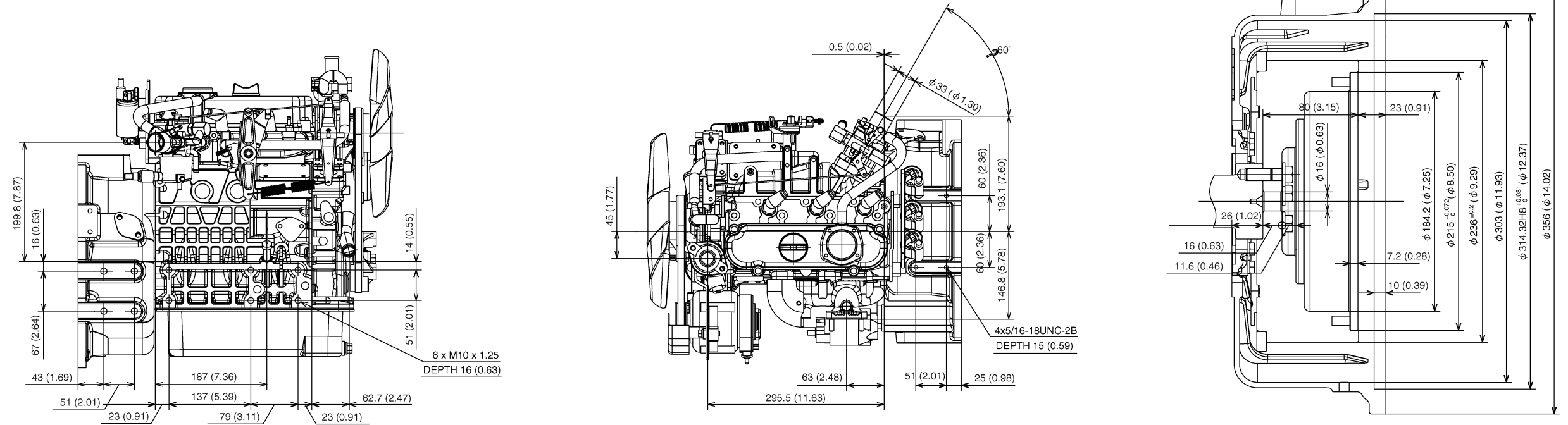
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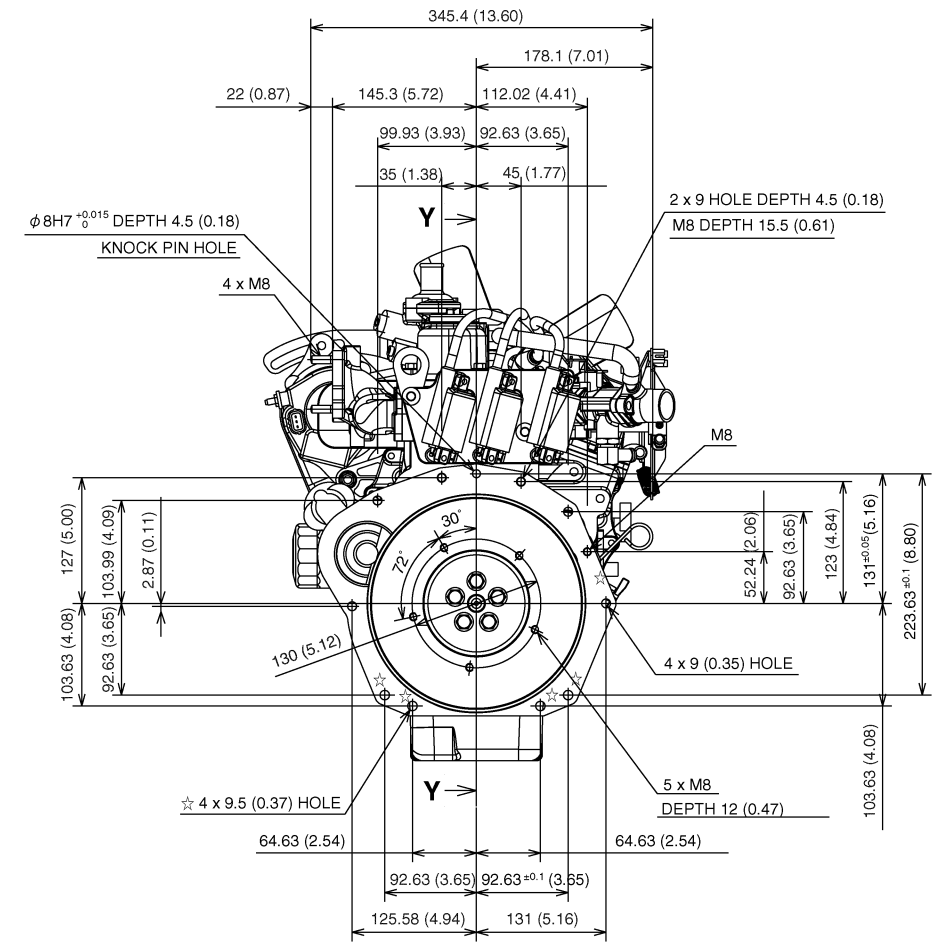
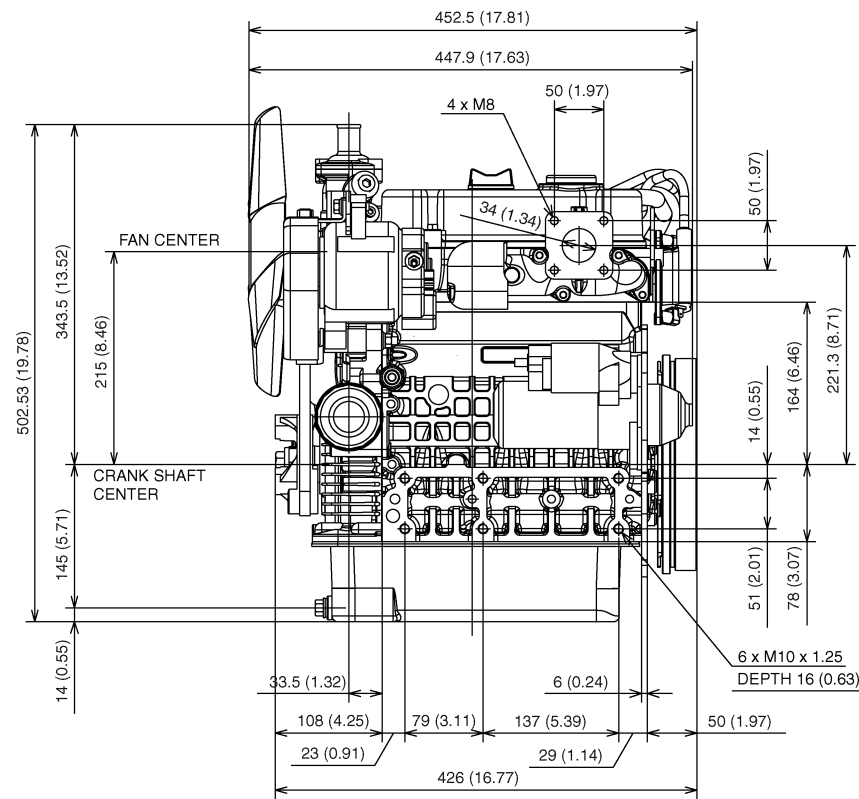
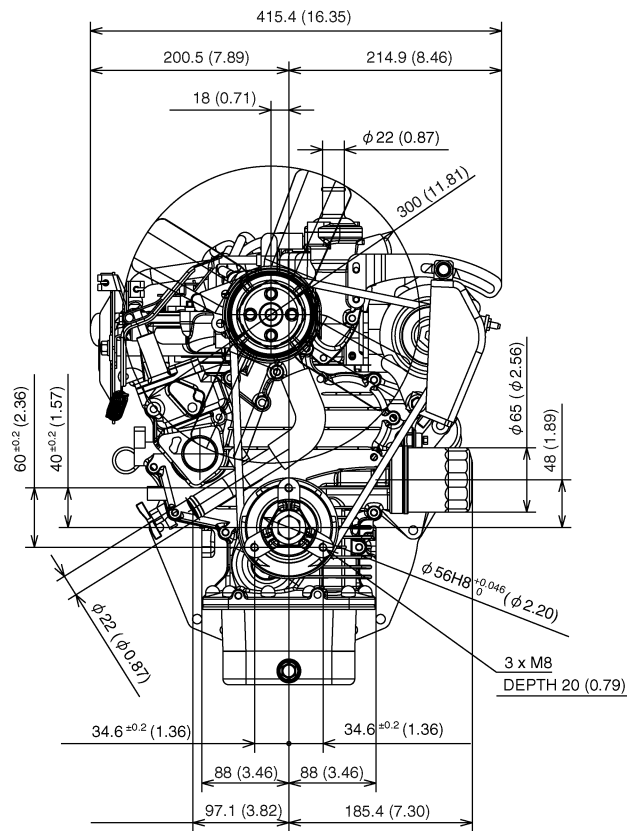
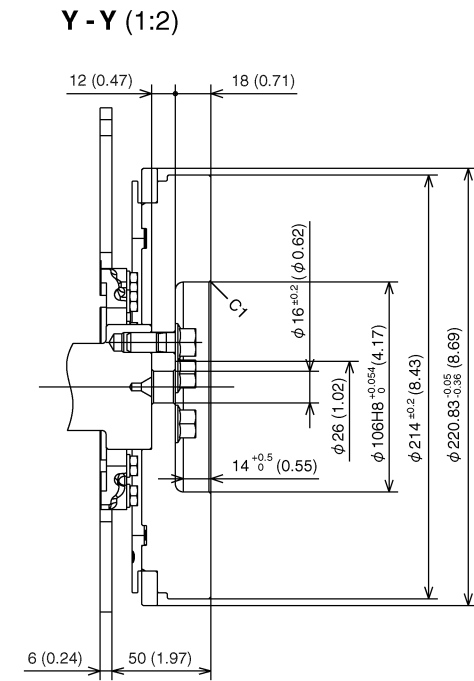
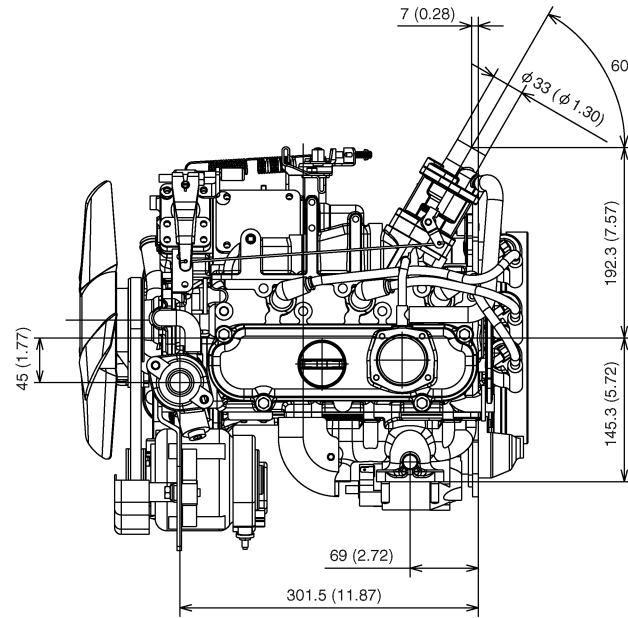
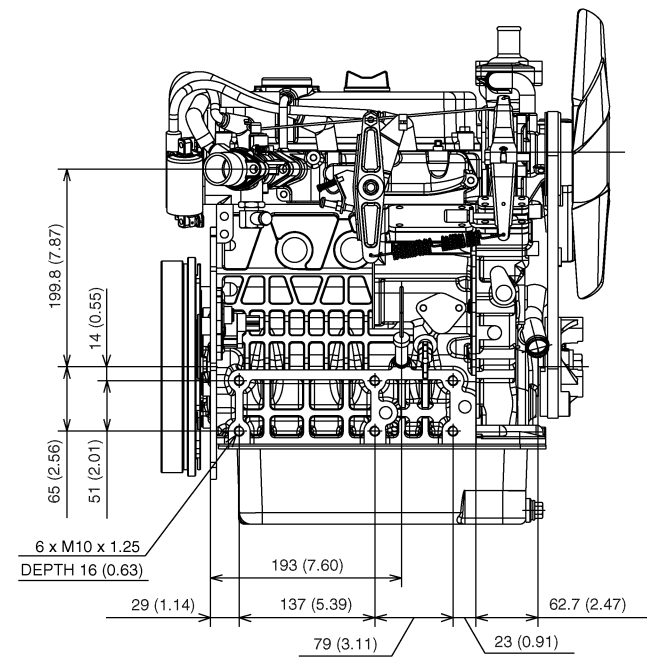


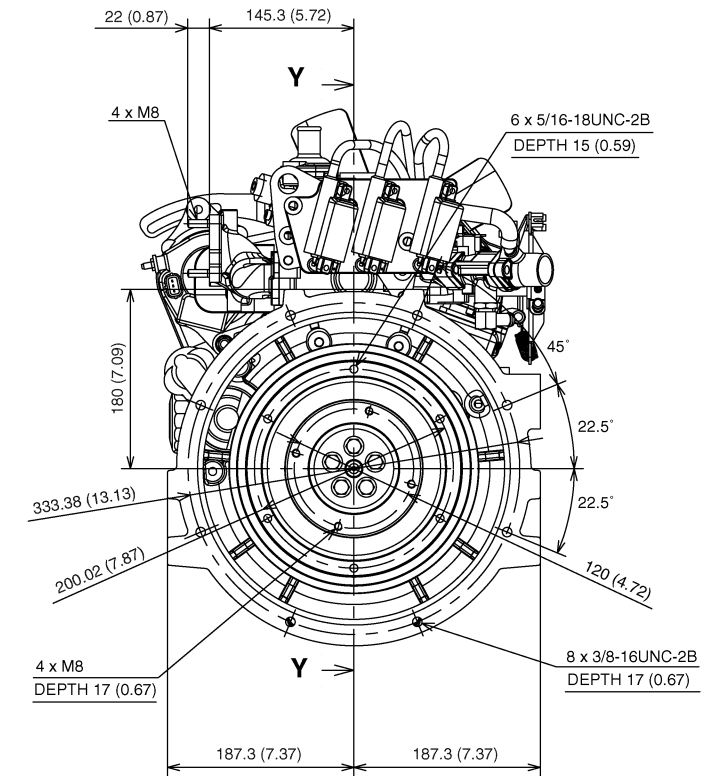
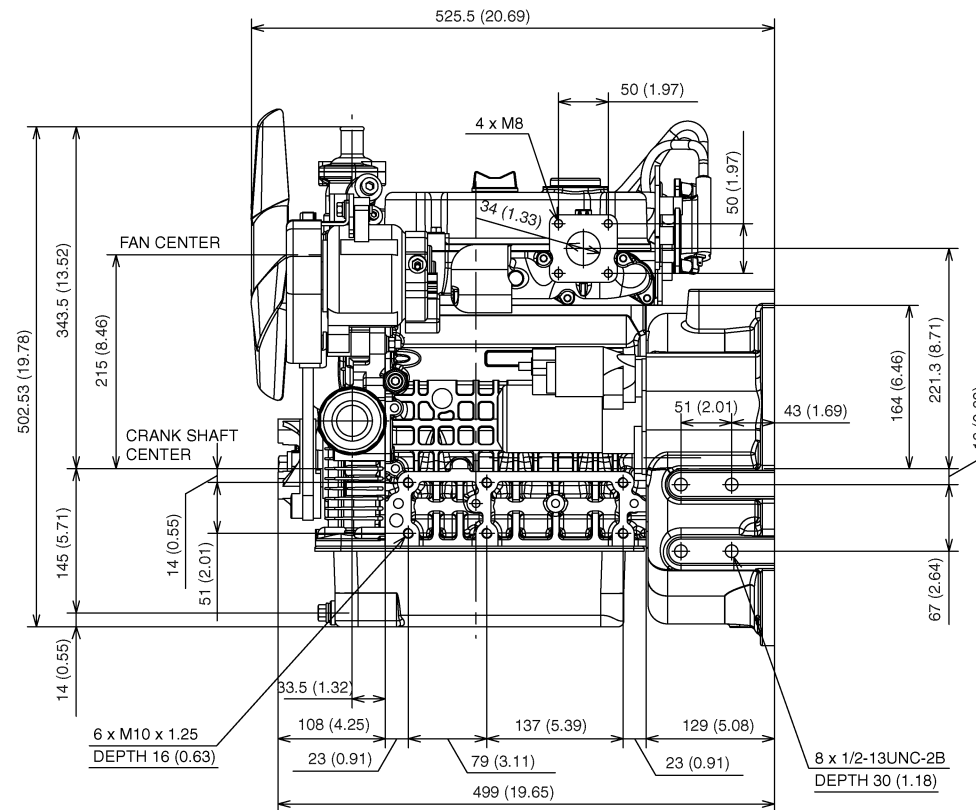
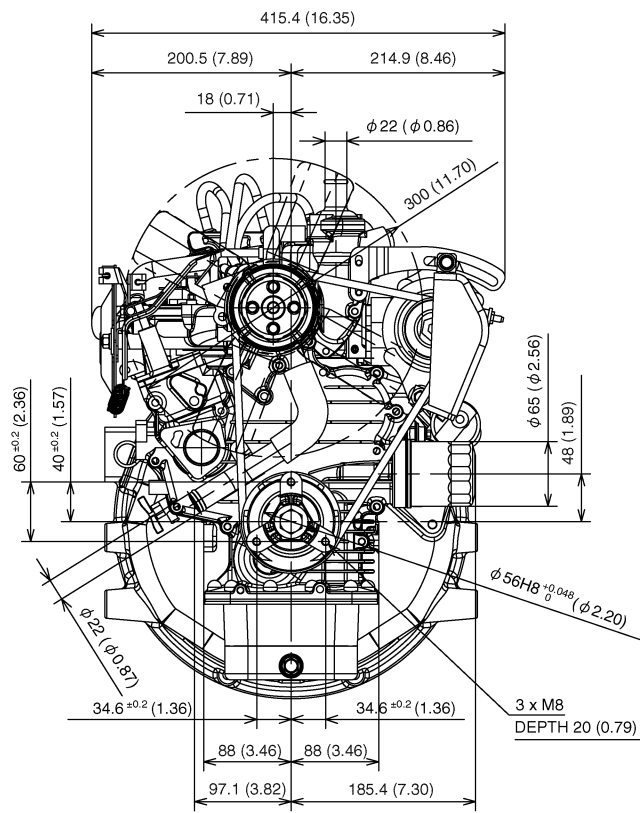
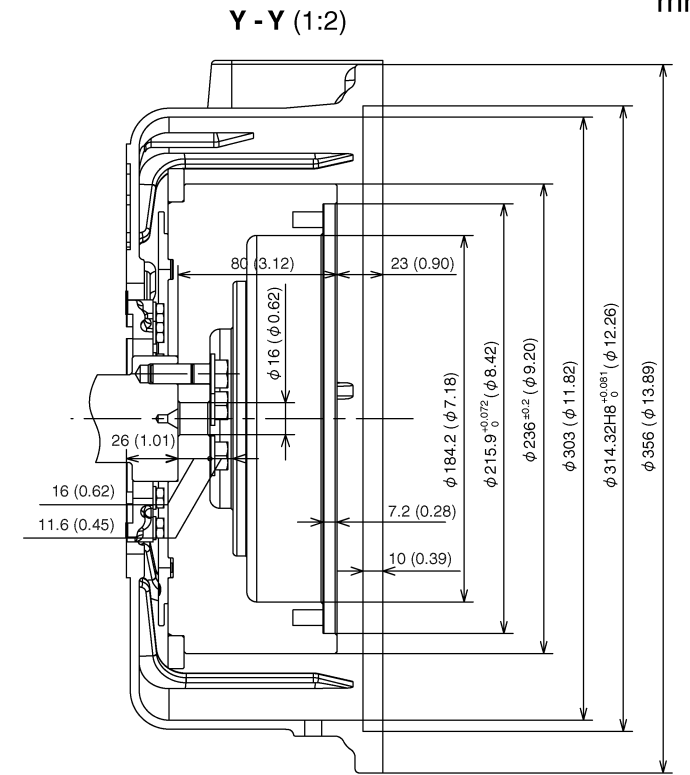
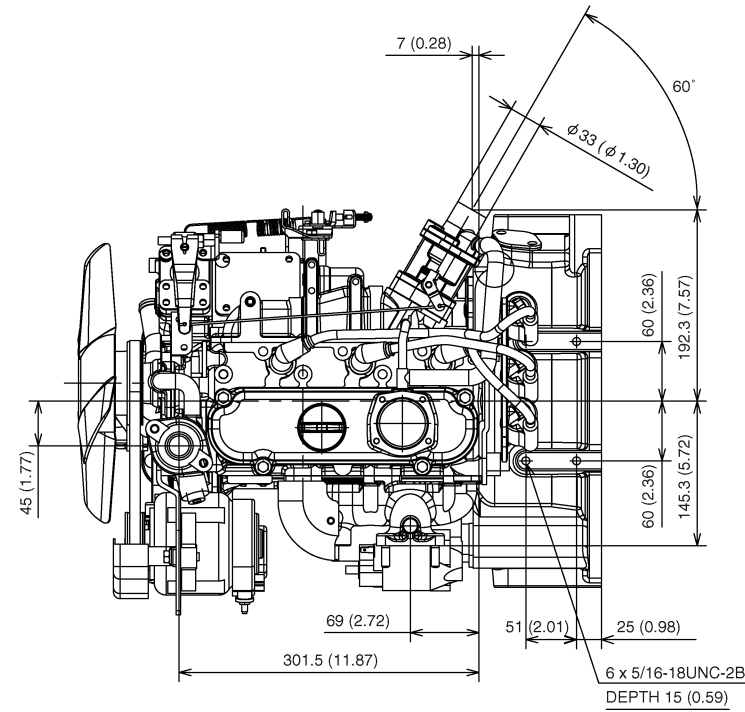
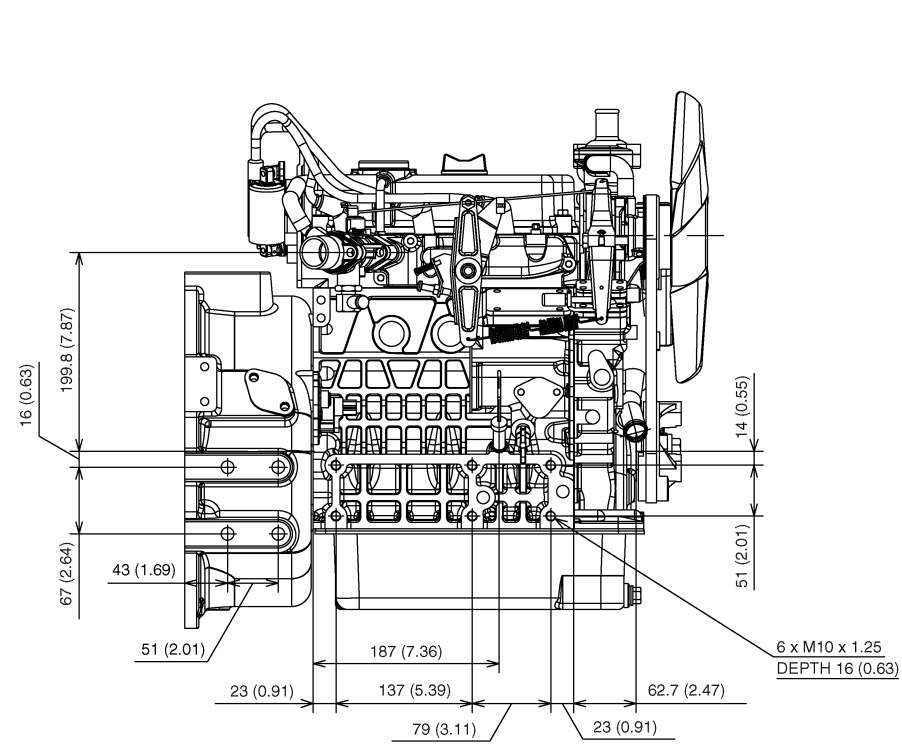








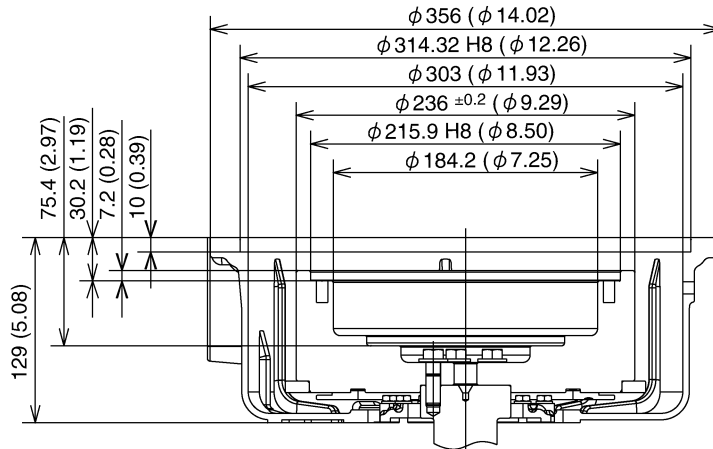
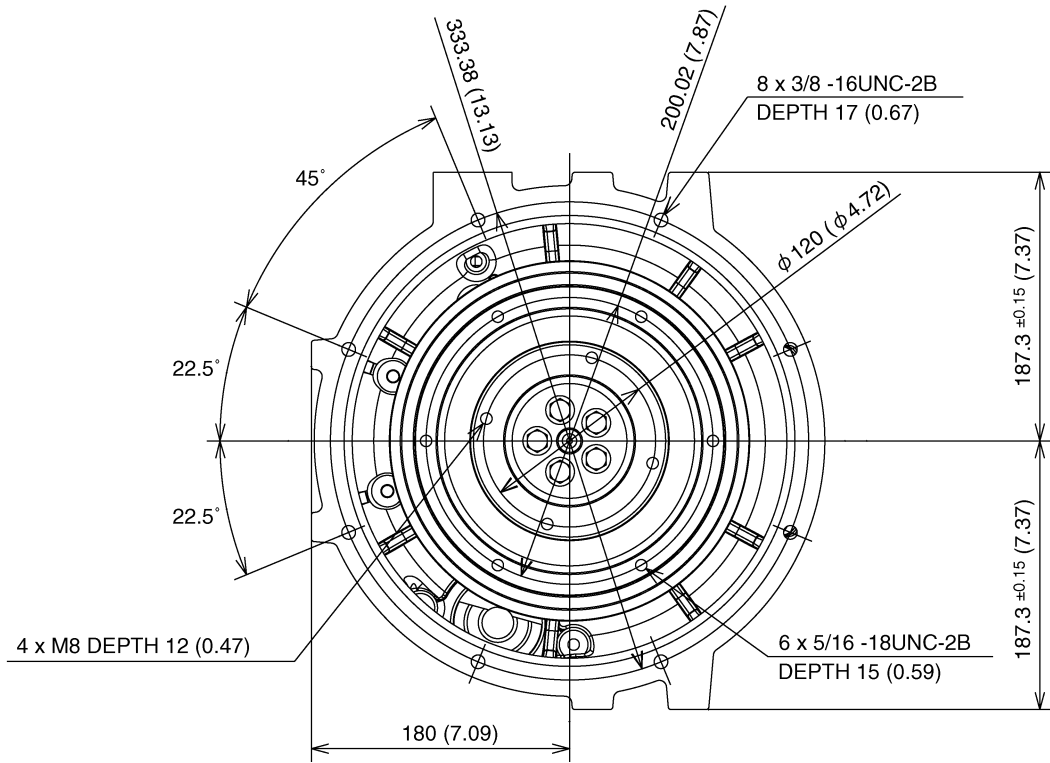




WG752, WG972, DG972

Flywheel : Normal SAE for Clutch No.6-1/2

Flywheel Housing : Normal SAE No.5



GEN009A

1. EMISSION REGULATION

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1. GENERAL

Along with E3 models, E2 models are yet available to be used in the following countries per output category.

kW, disp.	Model	Type	North America	Europe	Japan
P ≤ 19 0.225 ≤ L	WG752-G/GL-E3	E3	Available	Non-available	Available
	WG/DF752-E2	E2	Non-available	Available	Available
	DG972 *	E2	Available	Available	Available
19 < P ≤ 30 0.825 < L ≤ 1.0	WG972-G/GL-E3	E3	Available	Available	Non-available
	WG/DF972-E2	E2	Non-available	Available	Non-available

■ **NOTE**

- * DG972 is only for stationary use.
e.g.oil field and emergency generator.

Current and future emission regulations.

Countries		kW, disp.	HC+NO _x /CO (g/kWh)							
			2009	2010	2011	2012	2013	2014	2015	2016
USA	CARB	P ≤ 19 0.225 ≤ L	8.0/549 *							
		19 < P L ≤ 0.825	12.0/549	8.0/549 *						
		19 < P 0.825 < L ≤ 1.0	12.0/549	6.5/375 *					0.8/20.6 *	
	EPA	P ≤ 19 0.225 ≤ L	12.1/610	8.0/610 *						
		19 < P ≤ 30 L ≤ 1.0	12.1/610	8.0/610 *						
Canada	P ≤ 19 0.225 ≤ L	12.1/610	8.0/610							
Japan	P < 19 0.225 ≤ L	12.1/610								
	19 ≤ P < 560	HC/0.6 g/kWh, NO _x /0.6 g/kWh, CO/20 g/kWh								
EU	P ≤ 19 0.225 ≤ L	12.1/610								
	19 < P	None								

■ **NOTE**

- * with evaporative emission regulation

2. IMPORTANT ITEMS

[1] Important Notice

There are necessary emission-related items for compliance with emission regulations.
Please confirm whether emission-related items are certain on application review
(Exhaust Emission Check Sheet).

For mass-production Kubota prepares the installation instructions.

These instructions are provided for the final engine assemblers who must ensure the engine, exhaust system (catalyst), intake system, gasoline fuel system and etc, are Installed correctly in the engine's certified configuration.

(for EPA only)

Failing to follow these instructions when installing a certified engine in a piece of non-road equipment violates federal law (40CFR 1068. 105(b)),subject to fines or other penalties as described in the Clean Air Act.

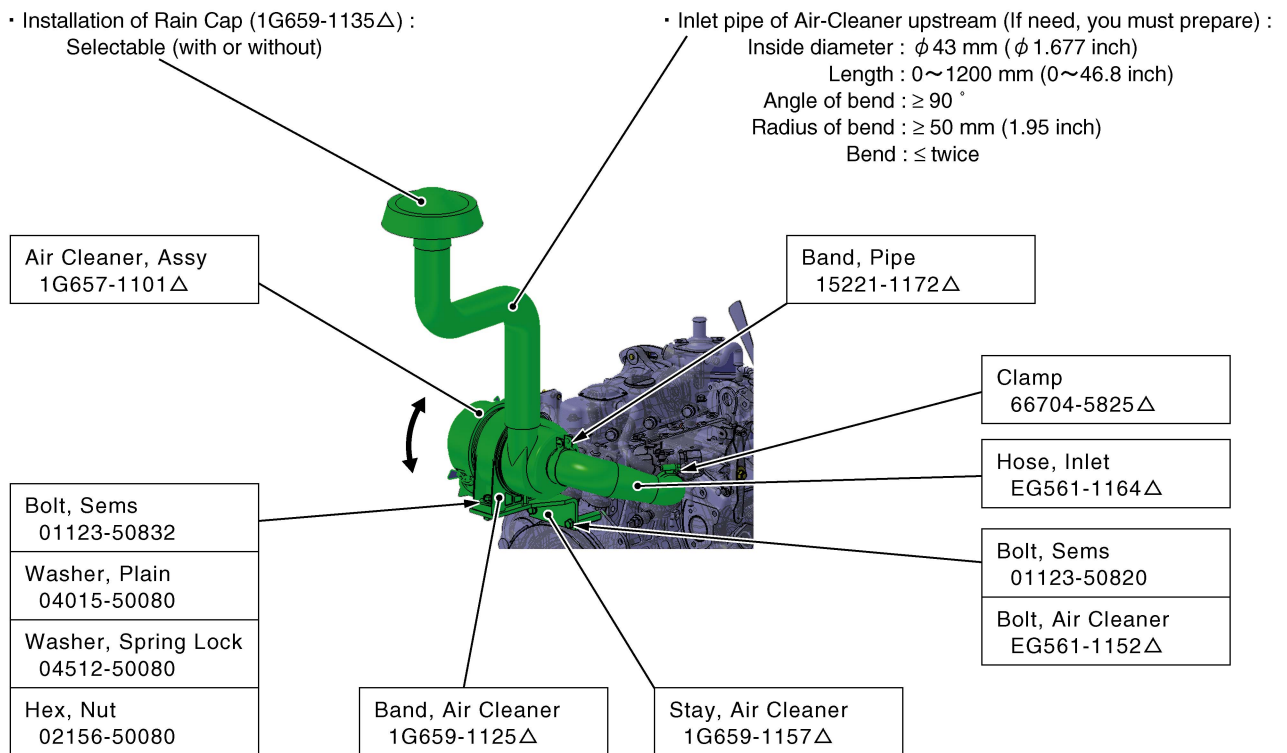
The contractual agreement contract is necessary before mass-production.

[2] Emission-Related Installation Instructions

(1) Air Intake System

- Intake system means that layout of all parts from entrance of suction to air-cleaner flange.
- Kubota offers standard Air-cleaner kit. The intake parts should be installed as shown in figure below.
- If you use an OEM intake system for a spec engine, consult Kubota based on the Exhaust Emission Check Sheet before the application review.
- When the same specification engine is installed on multiple applications, you will have to inform to Kubota prior to the application review.
Also, the final intake system of each application must be confirmed at the application review and/or the Exhaust Emission Check Sheet.
- You must install the intake system confirmed at the application review and/or the Exhaust Emission Check Sheet for mass-production. **(Important)**
- You should consult Kubota based on the Exhaust Emission Check Sheet whenever you change the intake system.
Do not change without consultation with Kubota.

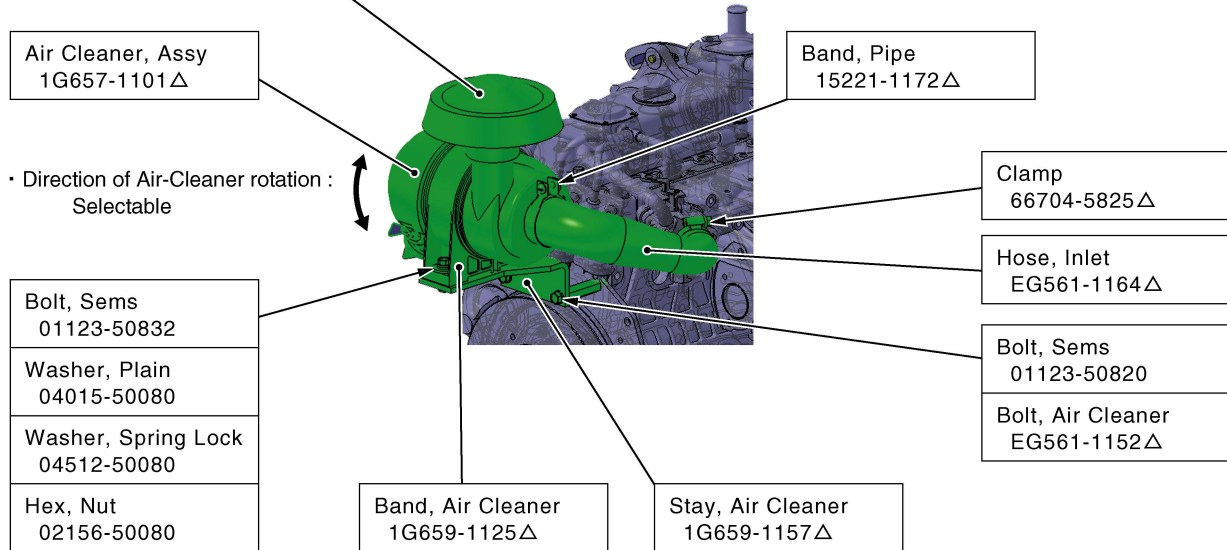
WG752, WG972



EMI001A

DG972-E2-BBH

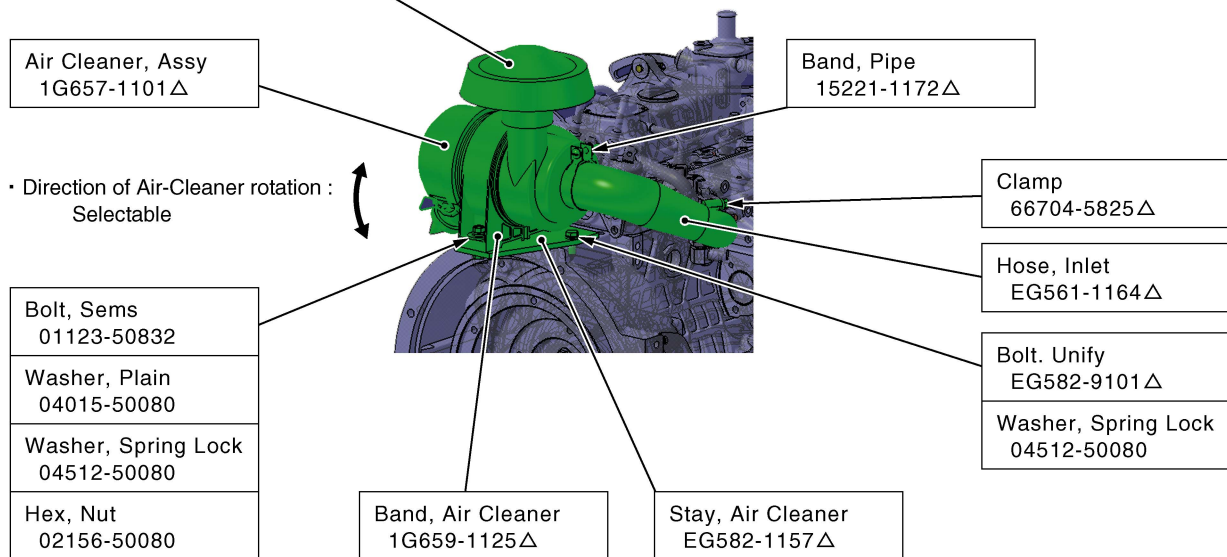
- Installation of Rain Cap (1G659-1135Δ) :
Selectable (with or without)



EMI002A

DG972-E2-SAEH, WG-972-GL-E3SAEH

- Installation of Rain Cap (1G659-1135Δ) :
Selectable (with or without)



EMI003A

(2) Exhaust System (See EXHAUST SYSTEM section) : (WG752, WG972)

- Exhaust system means the layout of all parts from exhaust manifold to exhaust exit to atmosphere.
- Kubota offers certified catalytic mufflers and catalytic converters.
You must only use Kubota certified catalyst parts (**Important**) and assemble the exhaust parts according to instructions as specified in the EXHAUST SYSTEM section of this manual.
Catalyst parts other than Kubota must not be used because other catalyst is not certified our engine.
You must install the exhaust system confirmed at application review and/or the Exhaust Emission Check Sheet for mass-production. (**Important**)
- You must consult Kubota based on the Exhaust Emission Check Sheet when you change the exhaust parts after application review. Do not change without the consultation with Kubota.

(3) High Altitude Operation (See FUEL SYSTEM section) : (WG752, WG972)

- Kubota prepared genuine altitude compensation kit.
The ultimate users must comply with the regulations through the installation of the appropriate altitude compensation kit.

(4) Evaporative Emission Controls

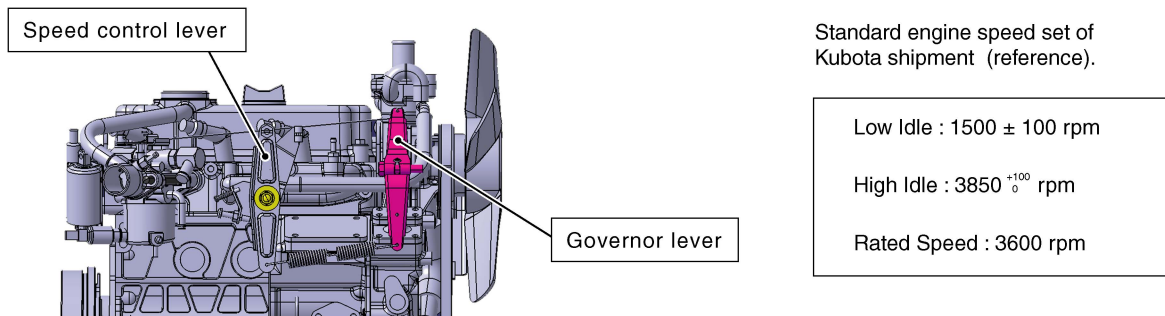
(See EVAPORATIVE EMISSION CONTROL section) : gasoline fuel

- If your equipments use a volatile liquid fuel (such as gasoline), they must meet the evaporative emission standards of 40 CFR part 1060, as described in §1054.112.

(5) Engine Set Speed

(Mechanical Governor specification)

- You should operate the engine within the range of engine speed set at the time of Kubota shipment (without parasitic load).
- You should use the speed control lever and/or the governor lever when the speed change.



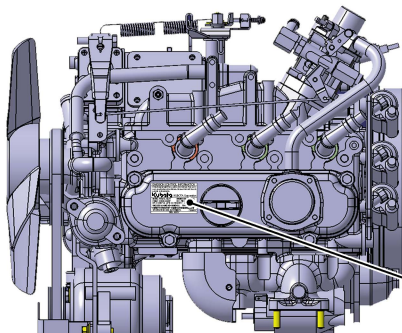
EMI004A

(Electronic Governor specification)

- If you use the electronic governor, consult Kubota before the application review.

(6) Engine Labels

- The following labels must be visible. If you install the engine in a way that makes the engine's emission control information label hard to read during normal engine maintenance, you must place a duplicate label on the equipment, as described in 40 CFR 1068.105.

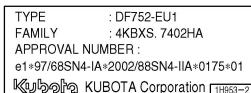
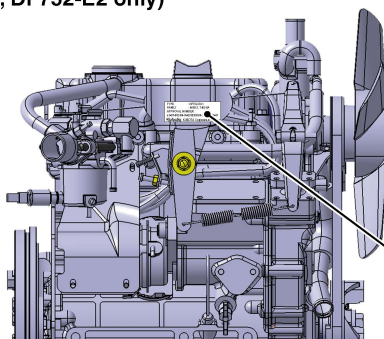


EPA/CARB Certification Label

- EPA / CARB certification label part numbers :
 - 1H965-8891Δ : WG972-G
 - 1H964-8891Δ : WG972-GL
 - 1H963-8891Δ : WG752-G
 - 1H962-8891Δ : WG752-GL
 - 1H959-8891Δ : DG972

EMI005A

(WG752-E2, DF752-E2 only)



EU Certification Label

- EU certification label part numbers:
 - 1H950-8896Δ : WG752-EU1
 - 1H951-8896Δ : WG752-EU2
 - 1H952-8896Δ : WG752-EU3
 - 1H953-8896Δ : DF752-EU1

EMI006A

(7) Vaporizer (WG752-GL, WG972-GL), Gas Regulator (DG972) Connections

(See FUEL SYSTEM section)

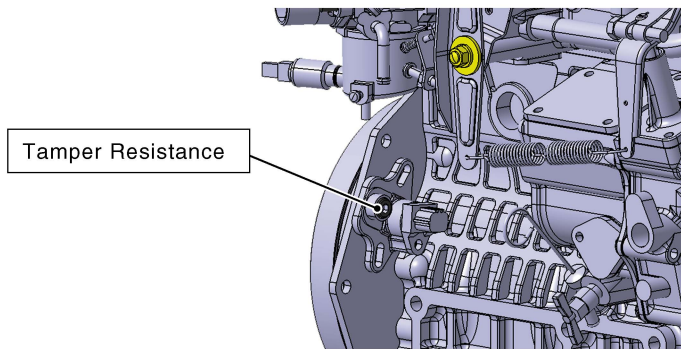
- The hose length between the vaporizer (gas regulator) and carburetor (gas mixer) must be within 300 ± 20 mm (11.8 ± 0.78 inch). Only use hose appropriate for LPG.

(8) Tamper Resistance

- Any modifications to the tamper resistance parts on this engine will cause this engine to be in noncompliance with emission regulations.

SENSOR (CRANK ANGLE) : (WG/DG972)

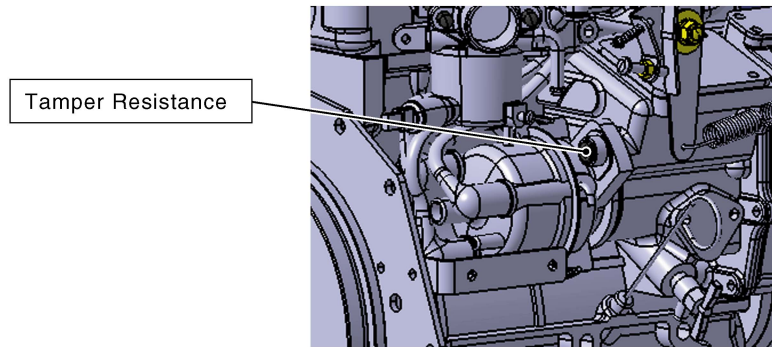
The ignition timing sensor also has a function of tamper resistant and the adjustment screw has been covered after adjustment at the factory. You **CAN NOT** adjust the ignition timing.



EMI007A

DISTRIBUTOR : (WG752)

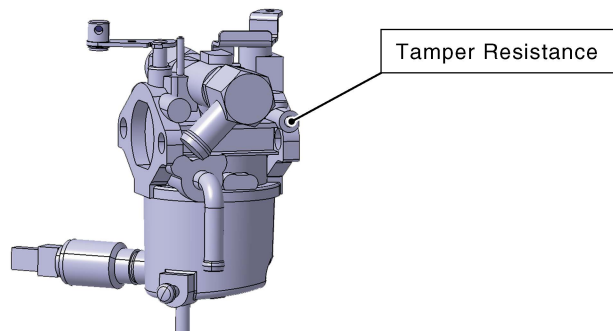
The distributor is tamper resistant ; the ignition timing adjustment screw has been covered after adjustment at the factory. You **CAN NOT** adjust the ignition timing.



EMI008A

CARBURETOR : (WG752, WG972)

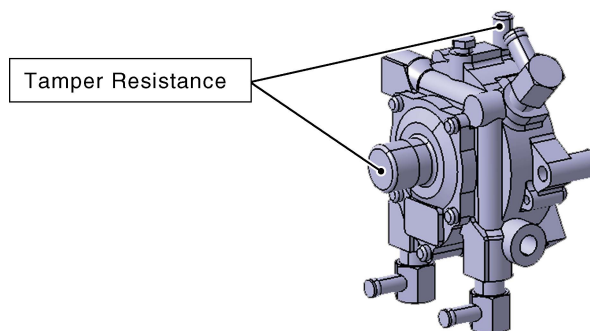
The carburetor is tamper resistant ; the idle mixture screw has been covered by tamper plug after adjustment at the factory. You **CAN NOT** adjust this screw.



EMI009A

LPG REGULATOR : (WG752-GL, WG972-GL)

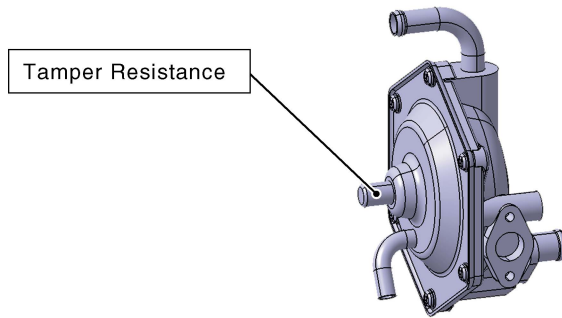
LPG regulator is tamper resistant ; the main and idle pressure adjustment screw have been covered by tamper caps after adjustment at the factory. You **CAN NOT** adjust the screws.



EMI010A

NATURAL GAS REGULATOR : (DG972)

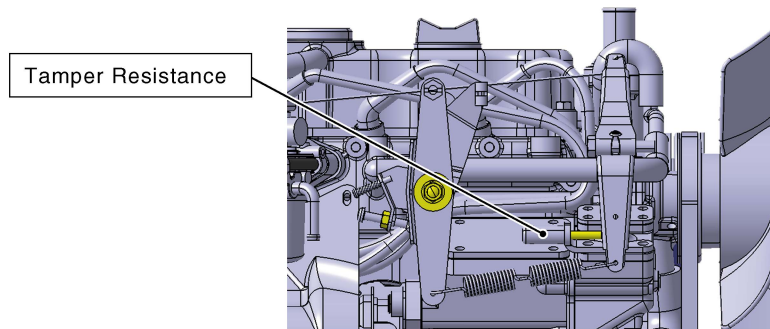
Natural gas regulator is tamper resistant; idle pressure adjustment screws have been covered by tamper caps after adjustment at the factory. You **CANNOT** adjust the screw.



EMI011A

GOVERNOR LEVER (THROTTLE ANGLE) : (Only spec model of specification that limits throttle angle)

The governor lever is tamper resistant; the governor lever adjustment screw has been covered after adjustment at the factory. You **CANNOT** adjust the governor lever.



EMI012A

2. FUEL SYSTEM

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1. GENERAL

Fuel by which Kubota guarantees performance.

[1] Gasoline

- Unleaded regular gasoline.
- E10 (10 % ethanol is added to gasoline)

[2] LPG

- Commercial liquid propane gas only.
- Equivalent to propane HD-5 of GPA * standards.
- KUBOTA RECOMMENDED LPG FUEL SPECIFICATIONS

C_3H_8	C_3H_6	C_4H_{10}	Others
≥ 90 %	≤ 5 %	≤ 2.5 %	–

(vol %)

■ NOTE

- * GPA means Gas Processors Association (U.S.A)

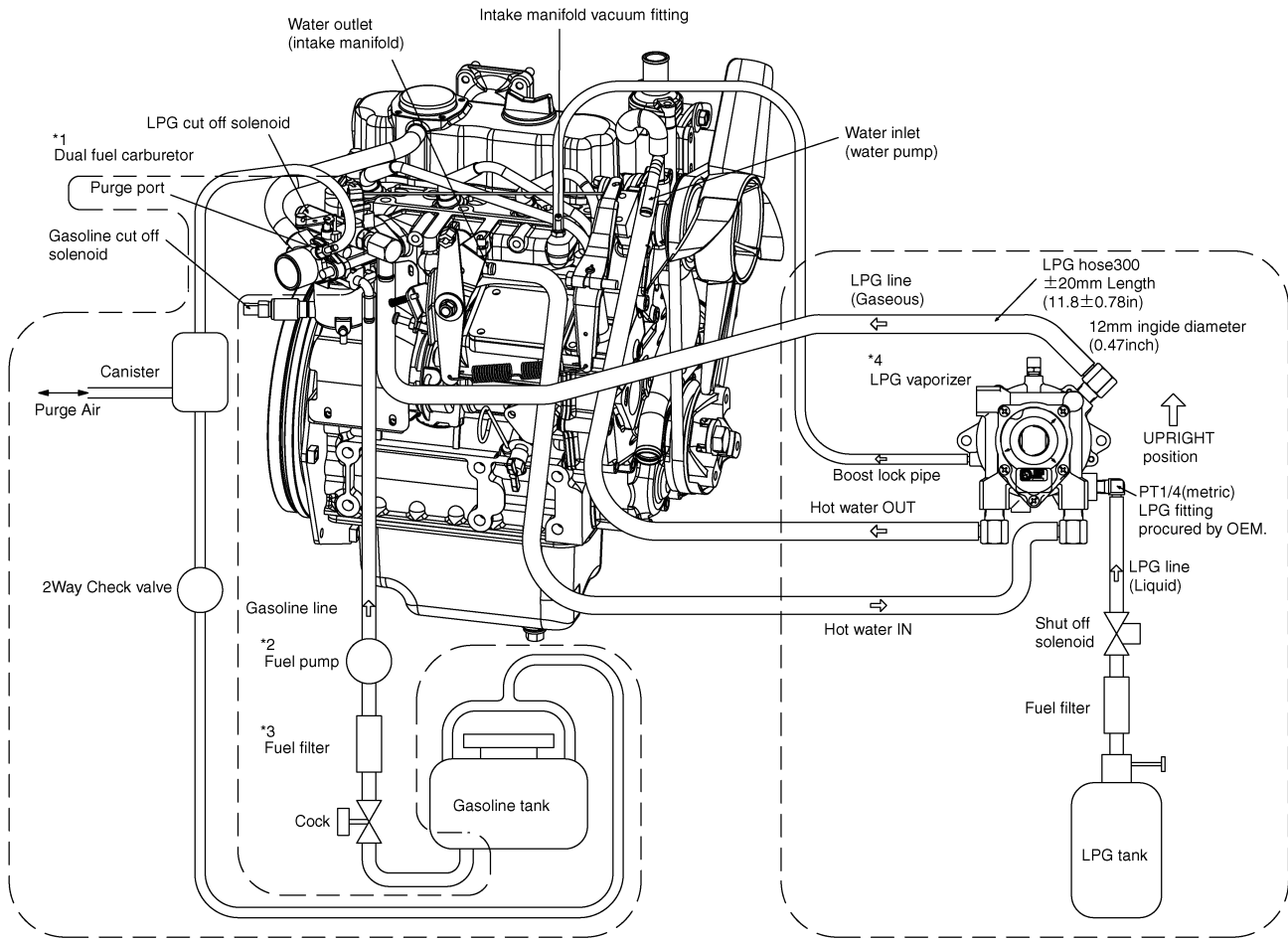
[3] Natural gas

- Natural gas equivalent to city gas.
- This manual describes the performance with Japanese standard natural gas.
The lower heating value : 9699 kcal/m³ (1090BTU/ft³).
- Supply pressure of natural gas : between 0.98 and 3.45 kPa.
- Consult KUBOTA for further information of fuel used.

2. FUEL DIAGRAM

WG752, WG972

- Mark * 1 to 4 are supplied by KUBOTA.
The other parts including hose should be procured by OEM.
The canister and the check valve should be procured by OEM if these are necessary for certification of Evaporative Emission Regulation.
- Each pipes should be surely connected by clamp.
- When gasoline tank location is lower than carburetor, gasoline cock is not needed.
When gasoline tank location is higher than carburetor, gasoline cock should be installed.
And gasoline cock should be surely closed when engine is in stop and operated by LPG.

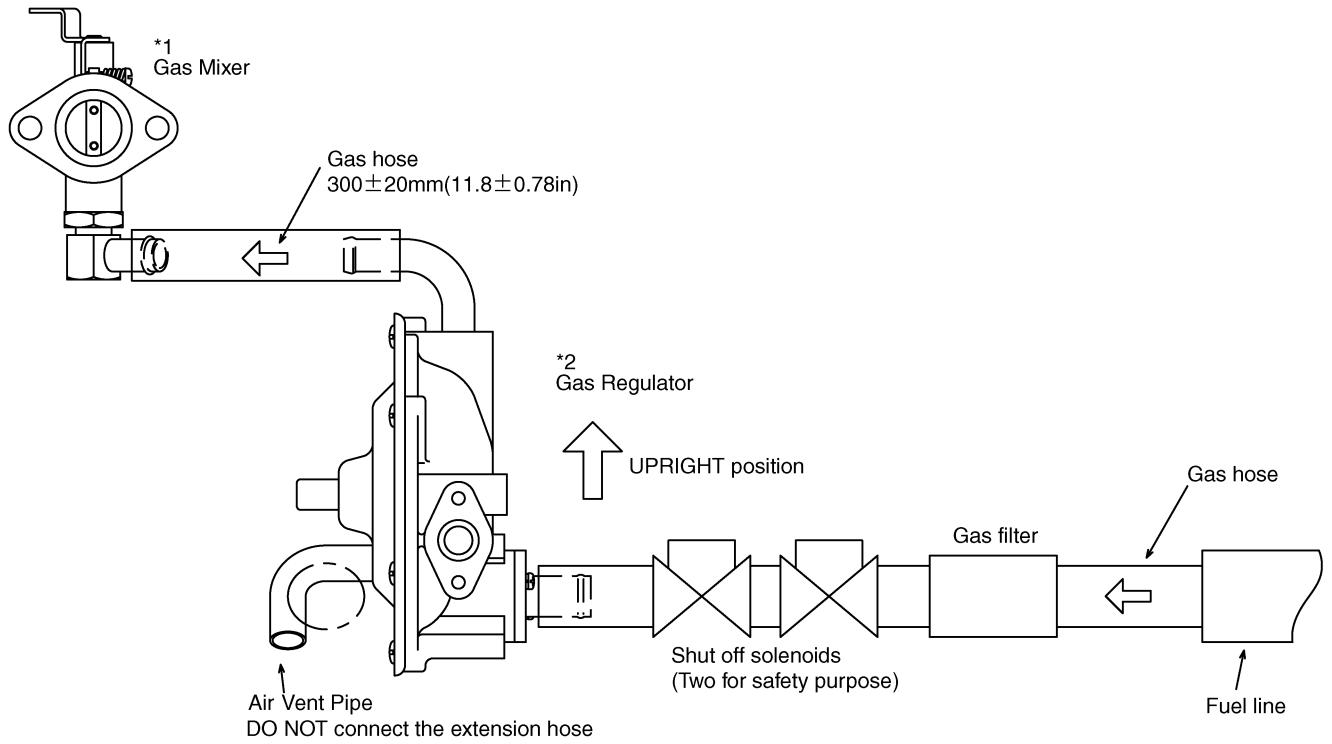


FUE001A Related evaporative emission regulation
See page "EVAPORATIVE EMISSION CONTROLS"

WG752-GL, WG972-GL only
See next page "CAUTIONS"

DG972 (See next page “CAUTIONS”)

- Mark * 1 to 2 are supplied by KUBOTA.
The other parts should be procured by OEM. (include hose)
- Each pipes should be surely connected by clamp.



FUE002A

3. CAUTIONS

[1] For safety (WG752-GL, WG972-GL, DG972)

- All fuel connections added to this engine must be installed by qualified personnel utilizing recognized procedures and standards.
- The non-KUBOTA installed parts, such as hoses, fittings, piping, shutoff solenoid valve should be approved for LPG (Natural gas) use and conform to UL, CSA, NFPA, MSHA and all other applicable standards.
- An approved, listed fuel filter (gas filter) and shutoff solenoid valve (for safety purpose for DG972, two valves) must be installed between the LPG tank and Kubota LPG regulator with vaporizer before the Kubota gas regulator.
- Two shutoff solenoid valves must shut off the gas when engine stalls (DG972).
- The following standards must be followed prior to installation: UL, CSA, NFPA and MSHA standards.

(1) Tightening torque and leak check for vaporizer and gas regulator

Each fitting must be sealed with approved joint sealant compound the joint must be installed to the gas entrance of the regulator by screw with O-ring. And fittings and screw are tightened to the specified torque using a wrench (driver), and leak check by a soap solution or its equivalent must be performed as shown in the below table.

Bubbles will indicate a loose connection.

TIGHTENING TORQUE AND LEAK CHECK PRESSURE

Fitting	Qty.	Size	Tightening torque			Leak check pressure			
			Nm	kgfm	ft-lb	kPa	kgf/cm ²	psi	
GL	LPG OUT (VAPOR)	1	R3/8	29.4 to 58.8	3.0 to 6.0	21.7 to 43.4	> 9.8	> 0.1	> 1.42
	LPG IN (LIQUID) *	1	R1/4	19.6 to 39.2	2.0 to 4.0	14.5 to 28.9	> 1471	> 15	> 213
	WATER IN/OUT	2	R3/8	29.4 to 58.8	3.0 to 6.0	21.7 to 43.4	> 245	> 2.5	> 35.6
DG	SCREW	2	M4	1.9 to 2.9	0.2 to 0.3	1.5 to 2.2	> 4.9	> 0.05	> 0.7

* NOT KUBOTA supplied

(2) Change the angle of LPG fitting of dual fuel carburetor and Gas fitting of gas mixer

The fitting may be mounted on any position since it is not sealed. The nut may be loosened using a wrench. Fitting may be changed to any specified angle. The nut should be tightened to the specified torque using a wrench as shown in the below table.

TIGHTENING TORQUE

Fitting	Qty.	Size	Tightening torque			Leak check	
			Nm	kgfm	ft-lb		
GL	LPG IN (VAPOR)	1	M12x1.25	11.8 to 26.5	1.2 to 2.7	8.7 to 19.5	Soap solution or its equivalent
DG	GAS IN (LOCK NUT)	1	M16x1	19.6 to 39.2	2.0 to 4.0	14.5 to 28.9	Soap solution or its equivalent

(3) Setting and vibration limits

Install the LPG regulator (gas regulator) in **UPRIGHT** position, it must be installed within 4G vibration level. If not, it may not supply necessary LPG fuel to the engine.

DO NOT connect the extension hose with the air vent pipe of the gas regulator.

If do this, it may not supply necessary fuel to the engine.

(4) Starting the engine (WG752-GL, WG972-GL)

Do not move the choke lever, when LPG starting.

Otherwise, the vaporizer might brake down.

[2] For emission regulations (WG752–GL, WG972–GL, DG972)

(1) Vaporizer and Gas regulator

In order to conform to applicable EPA and CARB Emissions regulations when operating WG752–GL, WG972–GL, DG972 engine, only a KUBOTA GENUINE VAPORIZER KIT (Gas regulator) can be used.

Vaporizer and Gas regulator can only be installed by an authorized KUBOTA DISTRIBUTOR or the manufacturer of the equipment in which this engine is used.

(2) Length of the gas hose

The hose length between the vaporizer (gas regulator) and carburetor (gas mixer) must be within $300 \pm 20\text{mm}$ ($11.8 \pm 0.78\text{inch}$).

The incorrect use of the hose may not conform to emission regulations.

5. EVAPORATIVE EMISSION CONTROL (gasoline fuel)

[1] Regulations

See the evaporative emission standards specified for your equipment in 40 CFR 1054.112 and CARB section 2754.

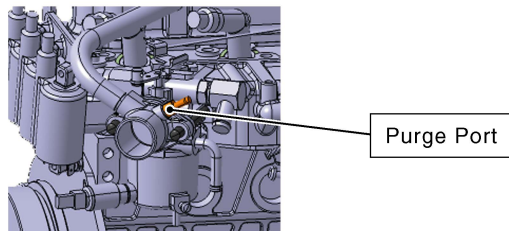
The standards and other requirements in 40 CFR part 1060 apply to the fuel lines, fuel tanks, fuel caps, canisters and others used or intended to your equipments and our engines.

- Nonmetal fuel lines must meet the permeation requirements specified in 40 CFR 1060.102.
- Fuel tanks must meet the permeation requirements specified in 40 CFR 1060.103 unless they are installed in equipment certified to meet diurnal emission standards under 40 CFR 1060.105 (e).
- Your equipment must have a tethered fuel cap. Fuel caps must also include a visual, audible, or other physical indication that they have been properly sealed (EPA 40 CFR 1060.101 (f) (1) (i), CARB section 2756).
- Your equipment must have proper carbon canisters that are installed on the fuel tanks subject to running loss or diurnal emission standards (EPA 40 CFR 1060.104 (b) (1), CARB section 2754).

KUBOTA recommendation

	Objective parts	Regulation requirements	Remarks
Equipment manufactures	Fuel Hose, Fuel Tank, Tank Cap, Canister	Use certified parts	40 CFR 1054.112 CARB section 2754
KUBOTA (engine)	* purge port	Add the purge port	

* To route running loss emissions into the engine intake system, Kubota prepared the purge port on the air-cleaner flange. You may use this purge port to combust fuel vapors vented from the fuel tank.



FUE004A

[2] Related Check Items

You must confirm that the fuel parts layout confirmed at application review. Please confirm the following items.

- Installation of heat cover, fuel hose, etc. confirmed.
- The temperature of the fuel in the fuel tank must be lower than temperature to prevent fuel boiling at all operating conditions.
- If you use a carbon canister, the capacity of fuel tank and the carbon canister is confirmed.
- The liquid gasoline does not enter from the fuel tank to the evaporative canister at all operating conditions (at inclination, volume expansion by heat, surface level difference by vibration and etc).

■ NOTE

- **It is equipment manufacturer's responsibility to make sure the fuel system will comply with the applicable evaporative emissions regulation.**
- **It is equipment manufacturer's responsibility to test and confirm the evaporative system will not cause engine performance issues at any operating condition.**

3. EXHAUST SYSTEM

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3. RELATED CHECK ITEMS.....	3-3
4. FOR MASS PRODUCTION (WG752, WG972).....	3-4

1. GENERAL (WG752, WG972)

Kubota offers certified catalytic mufflers and catalytic converters.

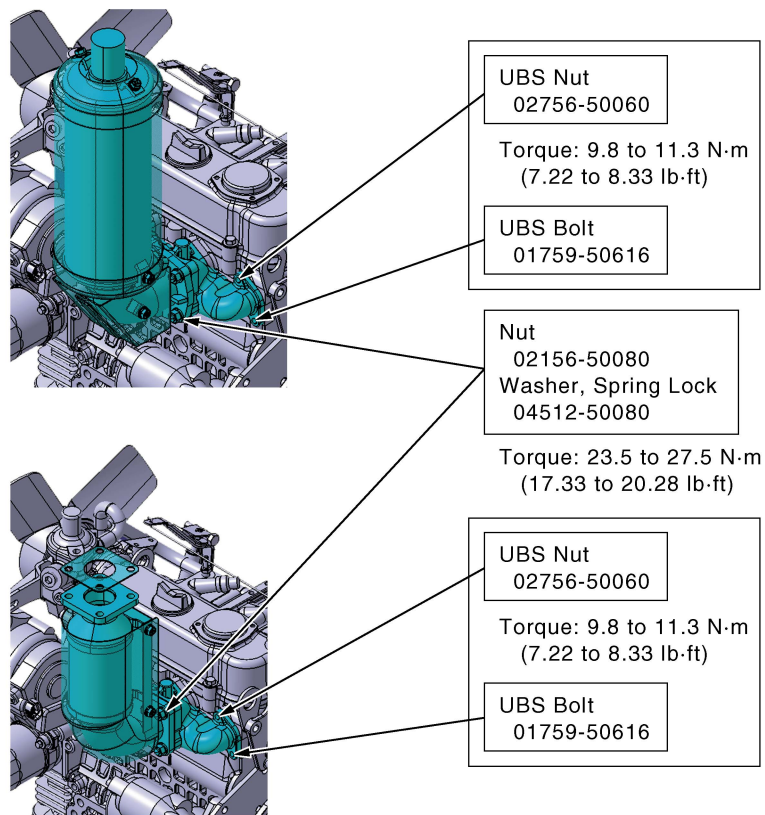
You should use only Kubota catalyst parts certified and assemble the exhaust parts as follows and/or the Exhaust Emission Check Sheet. Catalyst parts other than Kubota must not be used because other catalyst is not certified our engine.

You must consult Kubota when you change the exhaust parts after application review and/or the Exhaust Emission Check Sheet.

- You must install the catalyst parts directly to the exhaust manifold through the gasket. See SOS option manual about selectable combinations of the catalyst parts and the exhaust manifold.
- When you use the converter, you must install the converter in the direction where the elbow side of the converter is attached to the exhaust manifold.
- Tighten with the specified torque to avoid exhaust gas leak. (Exhaust Manifold, Catalyst)
When you use bolt to tighten the catalyst, the material of the bolt must be SAE10B23H.

■ IMPORTANT

- **Handle catalyst parts with care. Damaged or catalyst that has been 'dropped' cannot be used.**



EXH001A

2. EXCEPTIONS (WG752, WG972)

When it is necessary to offset the installation positions of the catalyst parts to avoid part interference or etc, a spacer can be used between the exhaust manifold and catalyst parts.

■ IMPORTANT

Only for WG752 with all exhaust manifold

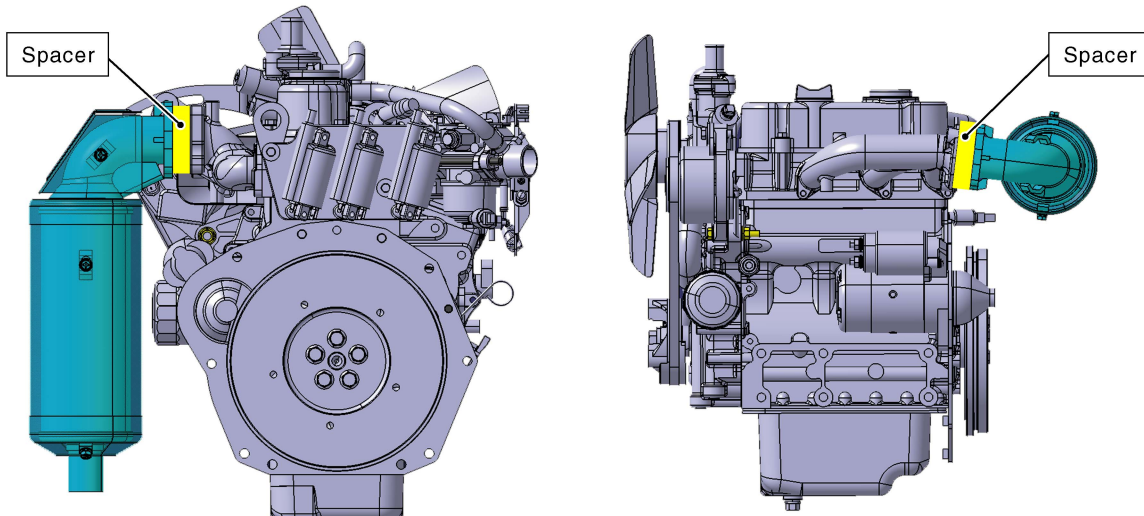
- Allowable max thickness of the spacer is 13 mm (0.51 inch).

Only for WG972 with the exhaust manifold (EG511-1231Δ, EG511-1233Δ)

- Allowable max thickness of the spacer is 20 mm (0.78 inch).

⚠ CAUTION

- Kubota gasket must be installed on both sides of the spacer.
- The surface-roughness of both Sides of the spacer must be less than 3.2a (3.2 μm).
And allowance of levelness must be less than 0.2 mm.
- The material of the spacer must be corresponding of SPHC.
- Tighten torque must be within 23.5 to 27.5 N·m (17.33 to 20.28 lb·ft)
- When change the stud on the exhaust manifold or use the bolt to tighten, the material of the stud and the bolt must be SAE10B23H.
- Refer to SOS option manual for the installation pitch and etc. of exhaust manifold and catalyst parts.



EXH003A

3. RELATED CHECK ITEMS

You must confirm that the other parts such as exhaust hoses layout around the catalyst parts confirmed at the time of the application review.

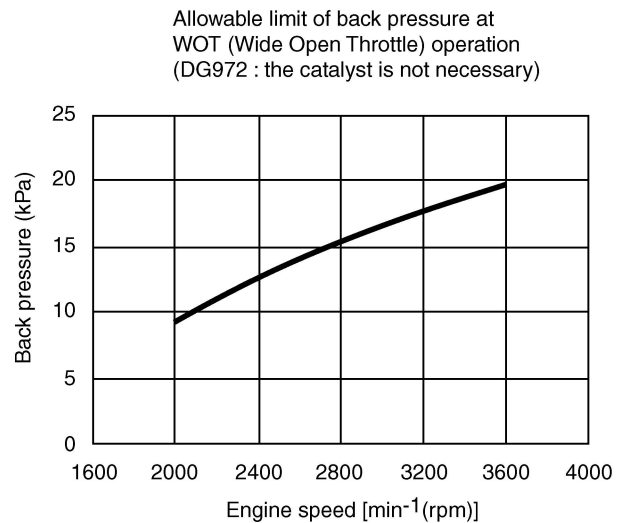
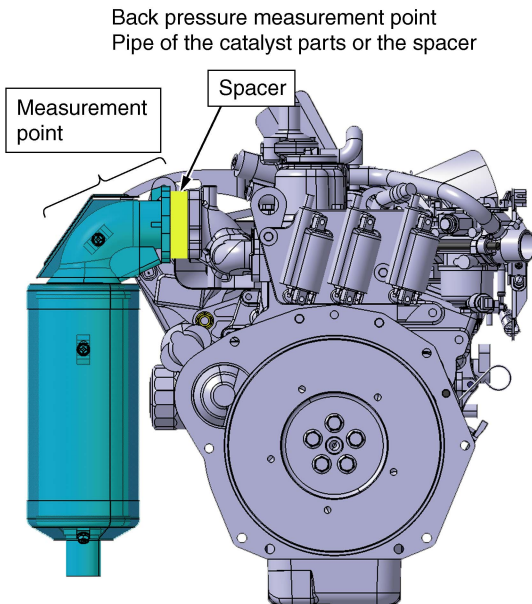
If the layout is not sure, the catalyst parts might be damaged.

Please confirm the following items.

- Installation of the heat cover confirmed.
- Installation of the stay of exhaust system confirmed at vibration test.
- Installation of the parts installed after Kubota catalyst parts.
- Installation of the other parts (ex. water cover, water cap, etc.) confirmed.
Water must be prevented from entering into exhaust catalyst.
- You confirm that the wiring of igniter and IG coil do not come off because of vibration, and not to disconnect during operation. If wiring comes off or disconnect, catalyst parts might be damaged and the exhaust temperature become very high.
- You must confirm layout of the parts (ex. add the cover etc) around the catalyst parts to avoid a fire because there is possibility that the surface of catalyst parts the exhaust become a high temperature when the engine abnormality driving. And you must guide user to stop engine immediately when the engine abnormality driving.
- When you use the Kubota catalytic converter with non-Kubota mufflers, it is necessary to confirm that the exhaust system back pressure is less than allowable limit. Refer to the curve below.

Check system back pressure, when you use a tail pipe with Kubota catalytic muffler, too.

Position to measure back pressure is at the outlet of exhaust manifold. Refer to the figurer below.



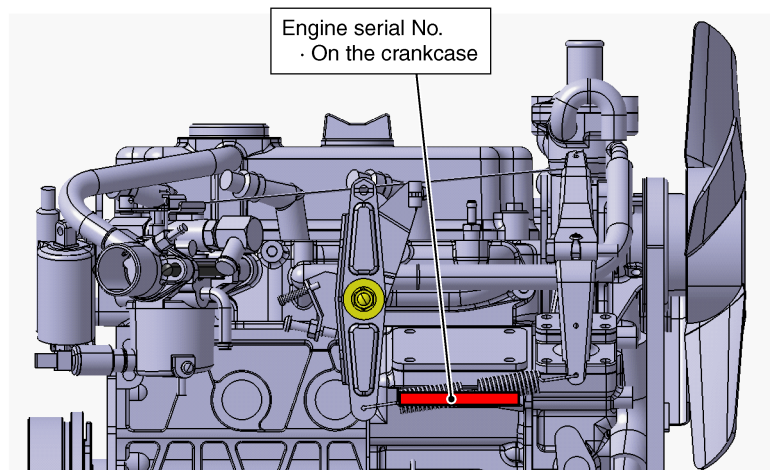
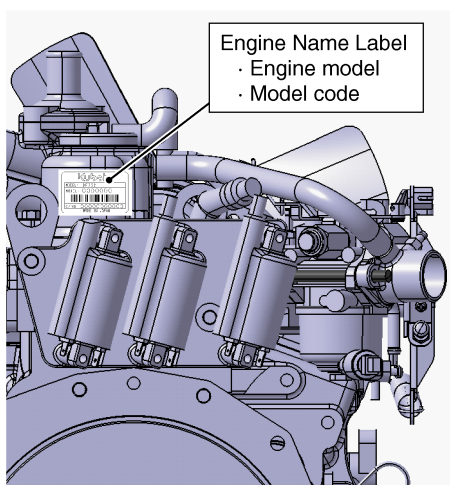
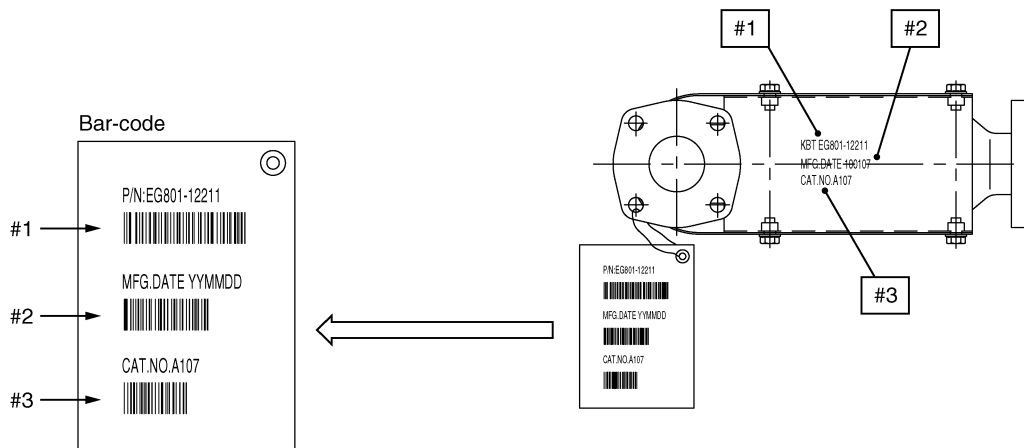
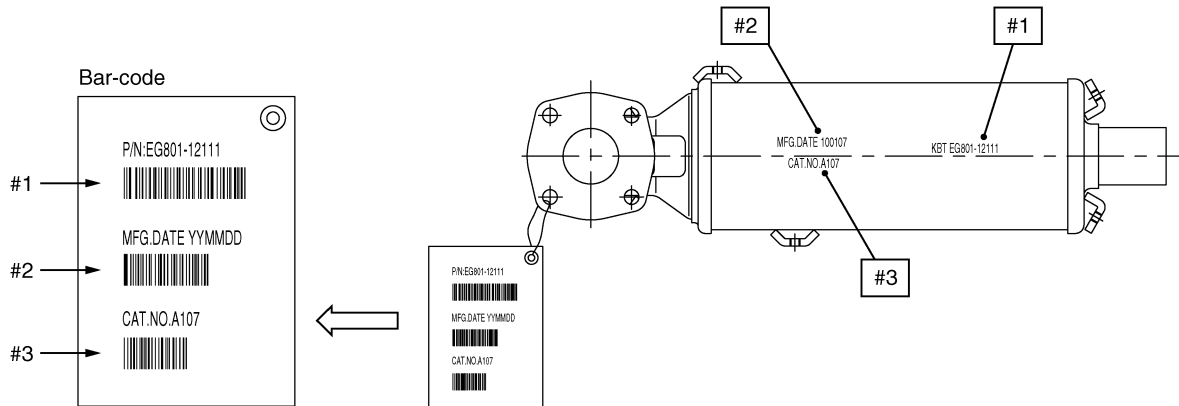
EXH004A

4. FOR MASS PRODUCTION (WG752, WG972)

The manufacturing number and the catalyst number are marked on surfaces of the catalyst parts. You must keep record of the catalyst identification information with the engine model and engine serial number that the catalyst is installed. (Check Item)

The catalyst parts are shipped with bar-code identification information.

- Catalyst Identification Marks
 - #1 Part number
 - #2 Manufacturing number
 - #3 Catalyst number



EXH005A

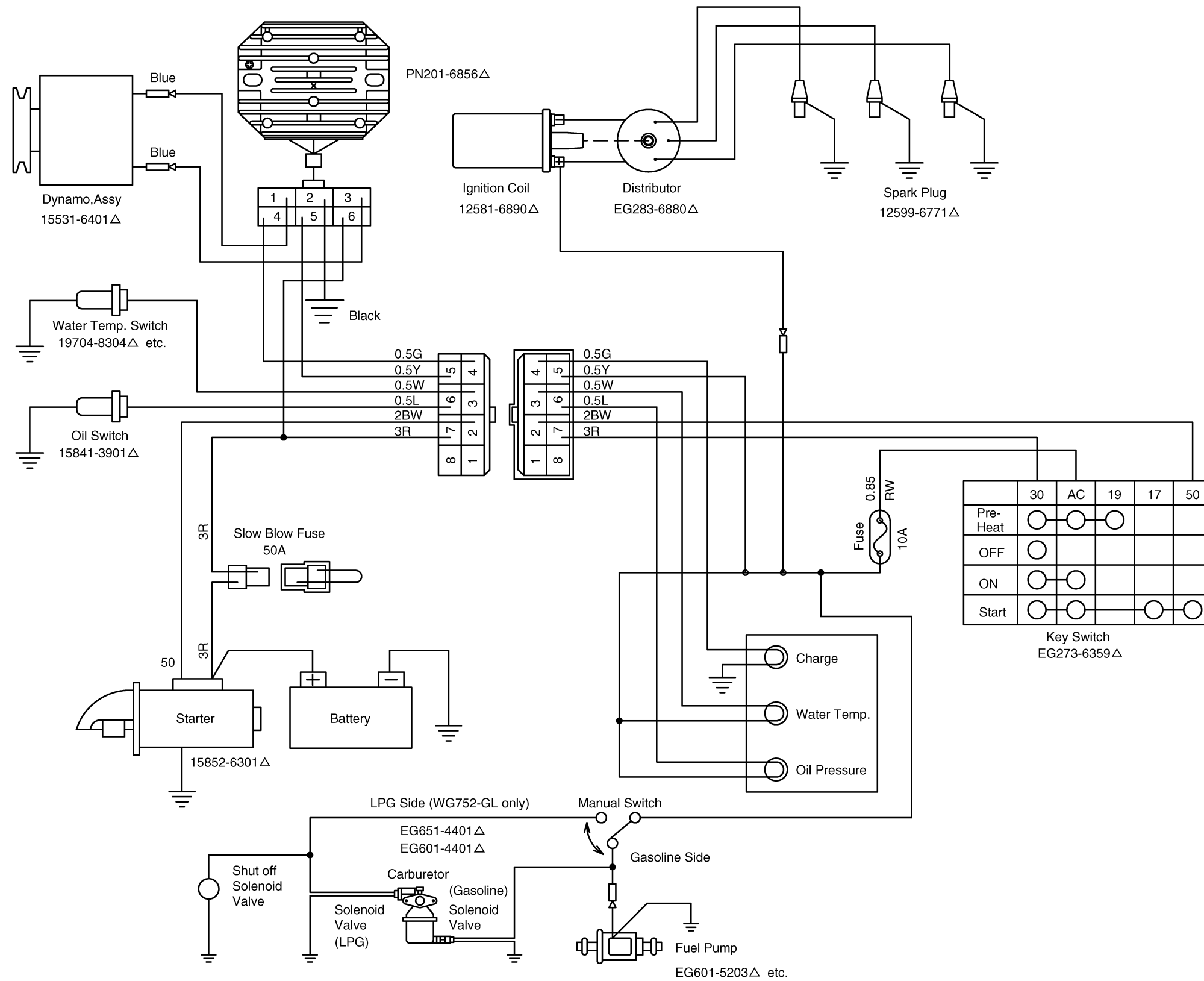
4. ELECTRICAL SYSTEM

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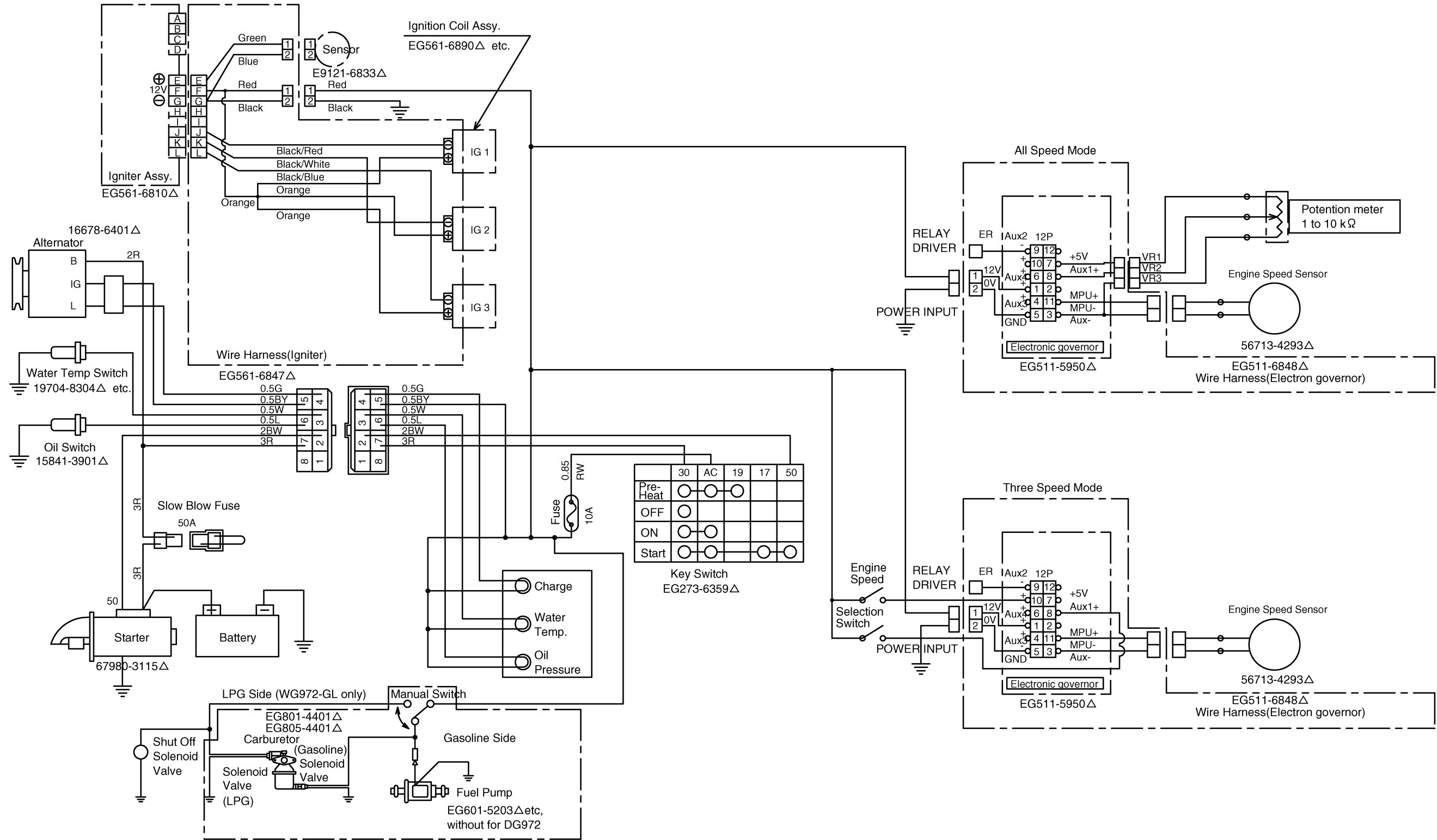
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2. CAUTION (WG752, WG972).....	4-3

1. WIRING DIAGRAM

WG752



ELC001A



2. CAUTION (WG752, WG972)

- Please confirm that the electrical wiring for the igniter and IG coil(s) do not disconnect due to vibration, poor routing or tension on wire and connector.
If wires become disconnected, catalyst parts may be damaged and very high exhaust gas temperature may result.
- Please confirm that the connecting order of cylinder number of the igniter and IG coil(s) do not make a mistake at mass-production and maintenance.
If the connecting order is not correct, catalyst parts may be damaged and very high exhaust gas temperature may result.

3 TECHNICAL INFORMATION

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1. BRAKE HORSE POWER

SAE J1349

Model	Fuel	Output		Engine Speed (min ⁻¹ (rpm))				
				2000	2400	2800	3200	3600
WG752	Gasoline	Net intermittent	kW	11.3	13.8	15.6	16.7	17.1
			HP	15.1	18.5	20.9	22.4	22.9
			PS	15.4	18.8	21.2	22.7	23.2
		Net continuous	kW	8.8	10.8	12.2	13.1	13.4
			HP	11.8	14.5	16.4	17.6	18.0
			PS	12.0	14.7	16.6	17.8	18.2
	LPG	Net intermittent	kW	10.7	13.1	14.9	16.0	16.4
			HP	14.3	17.6	20.0	21.4	22.0
			PS	14.5	17.8	20.3	21.8	22.3
		Net continuous	kW	8.2	10.2	11.5	12.4	12.7
			HP	11.0	13.7	15.4	16.6	17.0
			PS	11.1	13.9	15.6	16.9	17.3

Model	Fuel	Output		Engine Speed (min ⁻¹ (rpm))				
				2000	2400	2800	3200	3600
WG972	Gasoline	Net intermittent	kW	14.8	17.8	20.6	22.2	23.1
			HP	19.8	23.9	27.6	29.8	31.0
			PS	20.1	24.2	28.0	30.2	31.4
		Net continuous	kW	12.1	14.6	16.9	18.2	18.9
			HP	16.2	19.5	22.6	24.4	25.4
			PS	16.4	19.8	22.9	24.7	25.7
	LPG	Net intermittent	kW	14.7	17.8	20.1	21.2	22.0
			HP	19.8	23.8	26.9	28.5	29.5
			PS	20.0	24.1	27.3	28.9	29.9
		Net continuous	kW	11.9	14.4	16.3	17.2	17.5
			HP	16.0	19.3	21.8	23.1	23.5
			PS	16.2	19.6	22.1	23.4	23.8
DG972	NG *	Net intermittent	kW	10.0	13.9	16.1	17.4	17.6
			HP	13.4	18.6	21.6	23.3	23.6
			PS	13.6	18.9	21.9	23.7	23.9
		Net continuous	kW	8.3	11.4	13.3	14.3	14.5
			HP	11.1	15.3	17.8	19.2	19.4
			PS	11.3	15.5	18.1	19.4	19.7

NOTE

- Conversion rates

- 1 kW=1.35962 PS=1.34048 HP
- 1 PS=0.7355 kW=0.985925 HP
- 1 HP=0.7457 kW=1.01428 PS

- * Fuel detail

Japanese standard gas

- lower heating value : 9699 kcal/m³ (1090 BTU/ft³)
- supply pressure : 0.98 – 2.45 kPa (2.27 – 5.68 oz/inch²)

2. FUEL CONSUMPTION

Specific at net intermittent (SAE J1349)

Model	Fuel	Output		Engine Speed (min ⁻¹ (rpm))				
				2000	2400	2800	3200	3600
WG752	Gasoline	Brake horse power	kW	11.3	13.8	15.6	16.7	17.1
			HP	15.1	18.5	20.9	22.4	22.9
			PS	15.4	18.8	21.2	22.7	23.2
		Fuel consumption	g/kWh	325	315	323	343	347
			g/HPh	242	235	241	256	259
			g/PSh	239	232	238	252	255
	LPG	Brake horse power	kW	10.7	13.1	14.9	16.0	16.4
			HP	14.3	17.6	20.0	21.4	22.0
			PS	14.5	17.8	20.3	21.8	22.3
		Fuel consumption	g/kWh	301	296	306	322	337
			g/HPh	225	221	228	240	251
			g/PSh	221	218	225	237	248
		lb/HPh	0.495	0.487	0.503	0.530	0.554	

Model	Fuel	Output		Engine Speed (min ⁻¹ (rpm))				
				2000	2400	2800	3200	3600
WG972	Gasoline	Brake horse power	kW	14.8	17.8	20.6	22.2	23.1
			HP	19.8	23.9	27.6	29.8	31.0
			PS	20.1	24.2	28.0	30.2	31.4
		Fuel consumption	g/kWh	404	398	371	351	334
			g/HPh	301	297	276	262	249
			g/PSh	297	293	273	258	245
	LPG	Brake horse power	kW	14.7	17.8	20.1	21.2	22.0
			HP	19.8	23.8	26.9	28.5	29.5
			PS	20.0	24.1	27.3	28.9	29.9
		Fuel consumption	g/kWh	301	287	286	292	299
			g/HPh	224	214	213	218	223
			g/PSh	221	211	210	215	220
		lb/HPh	0.495	0.472	0.471	0.480	0.492	
DG972	NG	Brake horse power	kW	10.0	13.9	16.1	17.4	17.6
			HP	13.4	18.6	21.6	23.3	23.6
			PS	13.6	18.9	21.9	23.7	23.9
		Fuel consumption	g/kWh	380	310	298	293	285
			g/HPh	283	231	222	219	213
			g/PSh	279	228	219	216	210
			lb/HPh	0.625	0.510	0.490	0.482	0.469

■ NOTE

- Conversion rates
 - 1 kW=1.35962 PS=1.34048 HP
 - 1 PS=0.7355 kW=0.985925 HP
 - 1 HP=0.7457 kW=1.01428 PS
 - 1 kg=2.20462 lb (1 g=0.00220462 lb)
 - 1 lb=0.45359 kg

3. SOUND PRESSURE LEVEL

unit dB(A)

	min ⁻¹ (rpm)	Load ratio	Fuel	Sound pressure at 1 m (3.3 ft)
WG752	3850	0/4	Gasoline	89
			LPG	87
	3600	4/4	Gasoline	91
			LPG	89
	1500	0/4	Gasoline	72
			LPG	72

unit dB(A)

	min ⁻¹ (rpm)	Load ratio	Fuel	Sound pressure at 1 m (3.3 ft)
WG972 DG972	3850	0/4	Gasoline	90
			LPG	90
	3600	4/4	NG	90
			Gasoline	92
	1500	0/4	LPG	92
			NG	92
	0/4 × 1500	0/4 × 1500	Gasoline	72
			LPG	72
			NG	72

These data show the average sound pressure level at four points.

■ **NOTE**

- **Measurement conditions: With radiator, cooling fan, air cleaner and muffler.**

4. AIR REQUIREMENTS

[1] Combustion air requirements (At 25 deg.C and 1000 hPa)

Model	Fuel	Output		Engine Speed (min ⁻¹ (rpm))				
				2000	2400	2800	3200	3600
WG752	Gasoline	Combustion air requirements	L/sec	10.48	12.58	14.68	16.77	18.87
			m ³ /h	37.74	45.29	52.84	60.38	67.93
			in ³ /sec	640	768	896	1024	1152
			ft ³ /min	22.21	26.65	31.09	35.54	39.98
	LPG	Combustion air requirements	L/sec	9.99	11.99	13.99	15.98	17.98
			m ³ /h	35.96	43.16	50.35	57.54	64.74
			in ³ /sec	610	732	853	975	1097
			ft ³ /min	21.16	25.40	29.63	33.86	38.10

Model	Fuel	Output		Engine Speed (min ⁻¹ (rpm))				
				2000	2400	2800	3200	3600
WG972	Gasoline	Combustion air requirements	L/sec	13.63	16.35	19.08	21.81	24.53
			m ³ /h	49.06	58.87	68.69	78.50	88.31
			in ³ /sec	832	998	1164	1331	1497
			ft ³ /min	28.87	34.65	40.42	46.20	51.97
	LPG	Combustion air requirements	L/sec	12.99	15.58	18.18	20.78	23.38
			m ³ /h	46.75	56.10	65.45	74.81	84.16
			in ³ /sec	793	951	1110	1268	1427
			ft ³ /min	27.51	33.02	38.52	44.02	49.53
DG972	NG	Combustion air requirements	L/sec	12.35	14.81	17.28	19.75	22.22
			m ³ /h	44.44	53.33	62.22	71.11	80.00
			in ³ /sec	753	904	1055	1205	1356
			ft ³ /min	26.16	31.39	36.62	41.85	47.08

■ NOTE

- Combustion air requirements calculating formula

- $Q1 = Vh \cdot N \cdot C \cdot \eta \cdot 10^{-3}$

- Q1 : Amount of intake air (m³/min)
- Vh : Total displacement (L)
- N : Engine speed (min⁻¹ (rpm))
- C : Coefficient=0.5
- η : Intake efficiency
 Gasoline : 0.85
 LPG : 0.81
 Natural Gas: 0.77

[2] Cooling air requirements (At 25 deg.C and 1000 hPa)

Model	Fuel	Output		Engine Speed (min ⁻¹ (rpm))				
				2000	2400	2800	3200	3600
WG752	Gasoline	Cooling air requirements	L/sec	359.4	418.8	476.5	550.6	651.3
			m ³ /h	1294	1508	1715	1982	2345
			in ³ /sec	21933	25554	29078	33598	39742
			ft ³ /min	761.5	887.2	1009.5	1166.5	1379.8
	LPG	Cooling air requirements	L/sec	349.2	413.8	477.6	548.6	672.0
			m ³ /h	1257	1490	1719	1975	2419
			in ³ /sec	21307	25251	29146	33475	41005
			ft ³ /min	739.7	876.7	1011.9	1162.2	1423.6

Model	Fuel	Output		Engine Speed (min ⁻¹ (rpm))				
				2000	2400	2800	3200	3600
WG972	Gasoline	Cooling air requirements	L/sec	571.2	737.2	824.7	833.9	764.8
			m ³ /h	2056	2654	2969	3002	2753
			in ³ /sec	34859	44988	50328	50886	46668
			ft ³ /min	1210	1562	1747	1767	1620
	LPG	Cooling air requirements	L/sec	469.8	586.7	686.6	734.2	722.3
			m ³ /h	1691	2112	2472	2643	2600
			in ³ /sec	28668	35800	41896	44806	44077
			ft ³ /min	995	1243	1455	1556	1530
DG972	NG	Cooling air requirements	L/sec	420.6	518.3	600.2	633.0	577.9
			m ³ /h	1514	1866	2161	2279	2080
			in ³ /sec	25668	31628	36625	38630	35264
			ft ³ /min	891	1098	1272	1341	1224

■ NOTE

- Above data is decided by following conditions.
 - Using the standard radiator.
 - Engine is run as open unit.

[3] Combustion and cooling air requirements (At 25 deg.C and 1000 hPa)

Model	Fuel	Output		Engine Speed (min ⁻¹ (rpm))				
				2000	2400	2800	3200	3600
WG752	Gasoline	Combustion and cooling air requirements	L/sec	369.9	431.3	491.2	567.4	670.1
			m ³ /h	1331.6	1552.8	1768.3	2042.5	2412.5
			in ³ /sec	22572	26322	29974	34622	40894
			ft ³ /min	783.7	913.8	1040.6	1202.0	1419.7
	LPG	Combustion and cooling air requirements	L/sec	359.1	425.8	491.6	564.5	689.9
			m ³ /h	1292.9	1532.8	1769.8	2032.4	2483.8
			in ³ /sec	21916	25982	30000	34450	42102
			ft ³ /min	760.9	902.0	1041.5	1196.0	1461.7

Model	Fuel	Output		Engine Speed (min ⁻¹ (rpm))				
				2000	2400	2800	3200	3600
WG972	Gasoline	Combustion and cooling air requirements	L/sec	584.9	753.6	843.8	855.7	789.3
			m ³ /h	2105.5	2712.9	3037.7	3080.5	2841.5
			in ³ /sec	35690	45986	51492	52217	48165
			ft ³ /min	1239.1	1596.5	1787.7	1812.9	1672.2
	LPG	Combustion and cooling air requirements	L/sec	482.8	602.2	704.7	755.0	745.7
			m ³ /h	1738.0	2168.1	2537.1	2718.1	2684.5
			in ³ /sec	29461	36751	43005	46074	45504
			ft ³ /min	1022.8	1275.9	1493.1	1599.6	1579.8
DG972	NG	Combustion and cooling air requirements	L/sec	433.0	533.1	617.5	652.8	600.1
			m ³ /h	1558.7	1919.2	2222.9	2350.1	2160.4
			in ³ /sec	26422	32532	37680	39835	36620
			ft ³ /min	917.3	1129.4	1308.2	1383.0	1271.4

■ **NOTE**

- **Cooling fan and fan pulley specifications (Cooling fan Part No. 15881-7411Δ)**

Item	
Fan diameter	300 mm (11.81 in)
No. of blade and type of shape	4, S type
Diameter of fan driving pulley	100 mm (3.94 in)
Diameter of fan pulley	84 mm (3.31 in)

- **Conversion rates**

1 L=61.0237 in³=0.035315 ft³

1 ft³=28.3168 L

1 L/sec=3.6 m³/h=2.1189 ft³/min

5. EXHAUST GAS VOLUME

At 25 deg.C and 1000 hPa

Model	Fuel	Output		Engine Speed (min ⁻¹ (rpm))					
				1500	2000	2400	2800	3200	3600
WG752	Gasoline	Gas volume	L/sec	22.58	30.11	36.14	42.16	48.18	54.20
			m ³ /h	81.3	108.4	130.09	151.77	173.45	195.13
			in ³ /sec	1378	1837	2205	2573	2940	3308
			ft ³ /min	47.8	63.8	76.6	89.3	102.1	114.8
	LPG	Gas volume	L/sec	21.52	28.69	34.43	40.17	45.91	51.65
			m ³ /h	77.48	103.3	123.96	144.62	165.29	185.95
			in ³ /sec	1313	1751	2101	2451	2802	3152
			ft ³ /min	45.6	60.8	73.0	85.1	97.3	109.4

Model	Fuel	Output		Engine Speed (min ⁻¹ (rpm))				
				2000	2400	2800	3200	3600
WG972	Gasoline	Gas volume	L/sec	39.15	46.98	54.80	62.63	70.46
			m ³ /h	140.93	169.11	197.30	225.48	253.67
			in ³ /sec	2389	2867	3344	3822	4300
			ft ³ /min	82.9	99.5	116.1	132.7	149.3
	LPG	Gas volume	L/sec	37.30	44.76	52.23	59.69	67.15
			m ³ /h	134.29	161.15	188.01	214.87	241.73
			in ³ /sec	2276	2732	3187	3642	4098
			ft ³ /min	79.0	94.8	110.6	126.5	142.3
DG972	NG	Gas volume	L/sec	35.46	42.55	49.65	56.74	63.83
			m ³ /h	127.67	153.19	178.73	204.26	229.8
			in ³ /sec	2164	2597	3030	3462	3895
			ft ³ /min	75.1	90.2	105.2	120.2	135.2

■ **NOTE**

• **Conversion rates**

1 L=61.0237 in³=0.035315 ft³

1 ft³=28.3168 L

1 L/sec=3.6 m³/h=127.133 ft³/min

6. HEAT REJECTION TO COOLANT

Specific at net intermittent (SAE J1349)

Model	Fuel	Output		Engine Speed (min ⁻¹ (rpm))				
				2000	2400	2800	3200	3600
WG752	Gasoline	Brake horse power	kW	11.3	13.8	15.6	16.7	17.1
			HP	15.1	18.5	21	22.4	23
			PS	15.3	18.8	21.3	22.7	23.3
		Fuel consumption	g/kWh	325	315	323	343	347
			g/HPh	243	235	241	256	259
			g/PSh	239	231	238	252	255
			lb/HPh	0.535	0.517	0.531	0.564	0.571
		Heat rejection to cooling water	MJ/h	28.85	32.90	37.03	42.32	45.91
			kcal/h	6891	7859	8846	10110	10967
	BTU/h		27735	31631	35604	40689	44141	
	LPG	Brake horse power	kW	10.7	13.1	14.9	16	16.4
			HP	14.3	17.6	20	21.5	22
			PS	14.5	17.9	20.3	21.8	22.3
		Fuel consumption	g/kWh	301	296	306	322	337
			g/HPh	224	221	228	240	251
			g/PSh	221	218	225	237	248
			lb/HPh	0.495	0.487	0.502	0.53	0.554
		Heat rejection to cooling water	MJ/h	28.02	32.51	37.12	42.16	47.37
			kcal/h	6694	7766	8867	10072	11316
			BTU/h	26944	31255	35688	40539	45543

■ **NOTE**

- Heat rejection to cooling water calculating formula
- $H_o = H_u \cdot N_e \cdot b_e \cdot i$

H_o : Heat rejection to cooling water

H_u : Fuel lower heating value

Gasoline : 42.7 MJ/kg, 10201 kcal/kg, 18361 BTU/lb

LPG : 47.3 MJ/kg, 11300 kcal/kg, 20339 BTU/lb

NG : 49.5 MJ/kg, 11828 kcal/kg, 21285 BTU/lb

Japanese standard gas

lower heating value : 9699 kcal/m³ (1090 BTU/ft³)

supply pressure : 0.98 – 2.45 kPa (2.27 – 5.68 oz/inch²)

N_e : Brake horse power

b_e : Specific fuel consumption ratio

i : Dispersion ratio to cooling water

Model	Fuel	Output		Engine Speed (min ⁻¹ (rpm))				
				2000	2400	2800	3200	3600
WG972	Gasoline	Brake horse power	kW	14.8	17.8	20.6	22.2	23.1
			HP	19.8	23.9	27.6	29.8	31.0
			PS	20.1	24.2	28.0	30.2	31.4
		Fuel consumption	g/kWh	404	398	371	351	334
			g/HPh	301	297	276	262	249
			g/PSH	297	292	272	258	245
			lb/HPh	0.664	0.654	0.609	0.577	0.549
		Heat rejection to cooling water	MJ/h	44.37	47.51	54.81	58.90	64.88
			kcal/h	10599	11349	13094	14072	15501
	BTU/h		42058	45035	51957	55840	61509	
	LPG	Brake horse power	kW	14.7	17.8	20.1	21.2	22.0
			HP	19.8	23.8	26.9	28.5	29.5
			PS	20.1	24.1	27.3	28.9	29.9
		Fuel consumption	g/kWh	301	287	286	292	299
			g/HPh	224	214	213	218	223
			g/PSH	221	211	210	215	220
			lb/HPh	0.494	0.471	0.470	0.480	0.491
		Heat rejection to cooling water	MJ/h	36.49	37.80	45.63	51.87	61.28
kcal/h			8717	9031	10900	12391	14640	
BTU/h	34589		35837	43252	49167	58094		
DG972	NG	Brake horse power	kW	10.0	13.9	16.1	17.4	17.6
			HP	13.4	18.6	21.6	23.3	23.6
			PS	13.6	18.9	21.9	23.7	23.9
		Fuel consumption	g/kWh	380	310	298	293	285
			g/HPh	283	231	222	219	213
			g/PSH	279	228	219	216	210
			lb/HPh	0.624	0.509	0.489	0.483	0.47
		Heat rejection to cooling water	MJ/h	32.73	33.49	39.90	44.67	48.91
			kcal/h	7805	7979	9529	10683	11713
			BTU/h	30968	31638	37770	42398	46510

■ **NOTE**

- Heat rejection to cooling water calculating formula
- $H_o = H_u \cdot N_e \cdot b_e \cdot i$

H_o : Heat rejection to cooling water

H_u : Fuel lower heating value

Gasoline : 42.7 MJ/kg, 10201 kcal/kg, 18361 BTU/lb

LPG : 47.3 MJ/kg, 11300 kcal/kg, 20339 BTU/lb

NG : 49.5 MJ/kg, 11828 kcal/kg, 21285 BTU/lb

Japanese standard gas

lower heating value : 9699 kcal/m³ (1090 BTU/ft³)

supply pressure : 0.98 – 2.45 kPa (2.27 – 5.68 oz/inch²)

N_e : Brake horse power

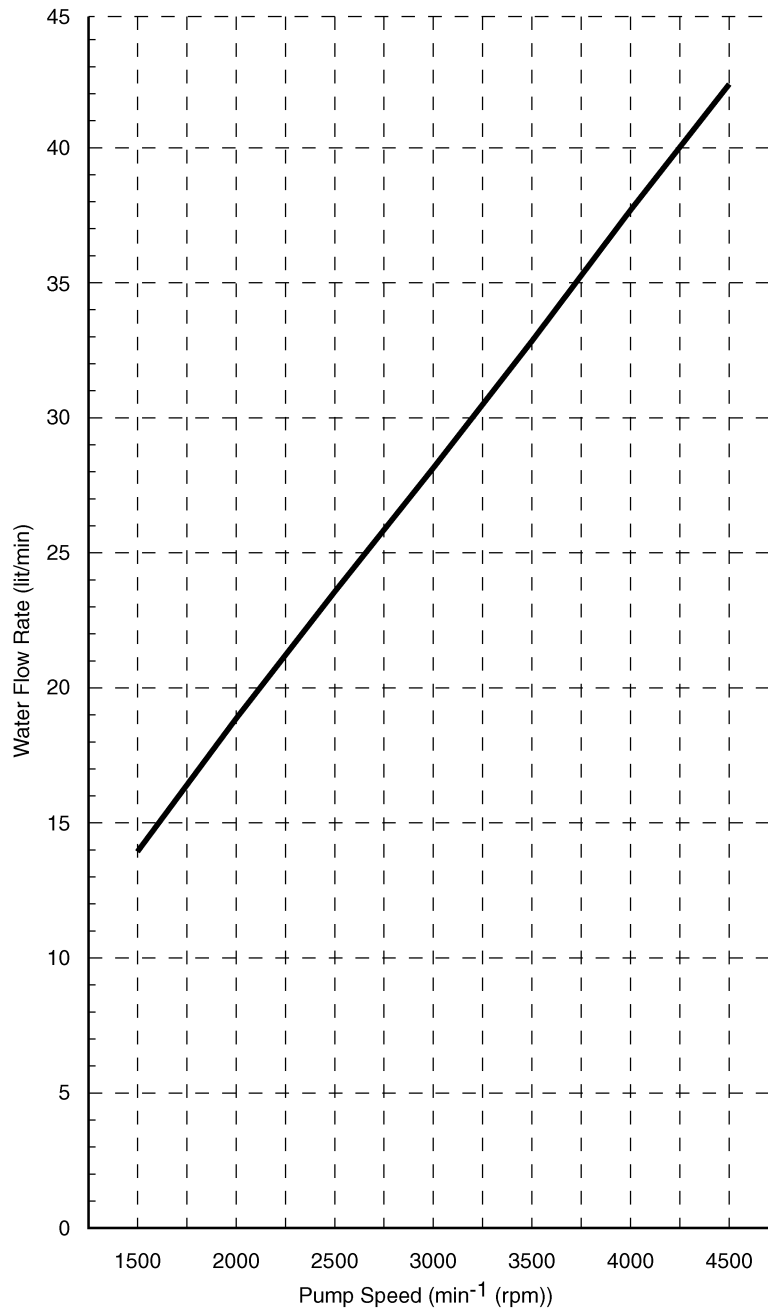
b_e : Specific fuel consumption ratio

i : Dispersion ratio to cooling water

7. WATER FLOW RATE

[1] WATER FLOW RATE OF WG752

Water Pump	1E051-7303Δ
Fan Pulley Dia.	84 mm (3.31 in.)
Fan Drive Pulley Dia.	100 mm (3.94 in.)
Thermostat	19203-7301Δ



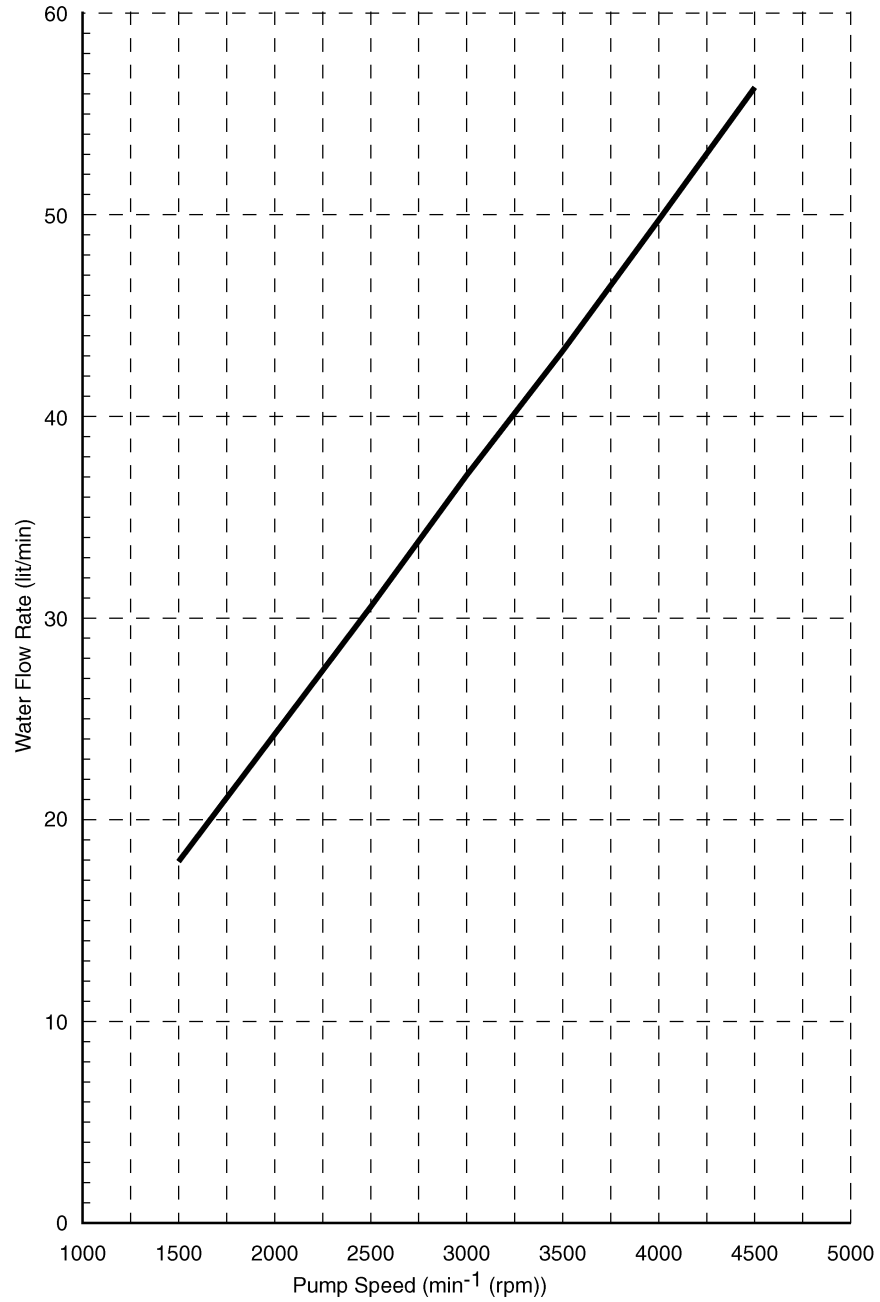
TEC001A

■ **NOTE**

- The flow is with std. radiator.
- Including engine block, radiator and piping resistance.

[2] WATER FLOW RATE OF WG972, DG972

Water Pump	1E051-7303Δ
Fan Pulley Dia.	84 mm (3.31 in.)
Fan Drive Pulley Dia.	100 mm (3.94 in.)
Thermostat	19434-7301Δ



TEC002A

■ **NOTE**

- The flow is with std. radiator.
- Including engine block, radiator and piping resistance.

8. CENTER OF GRAVITY

1. With standard flywheel and rear-end plate

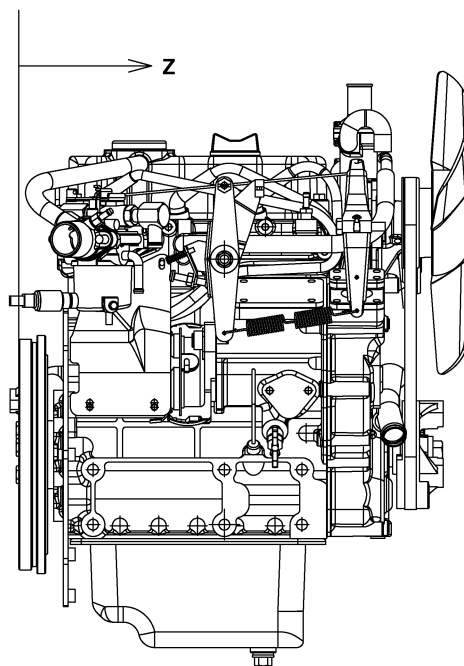
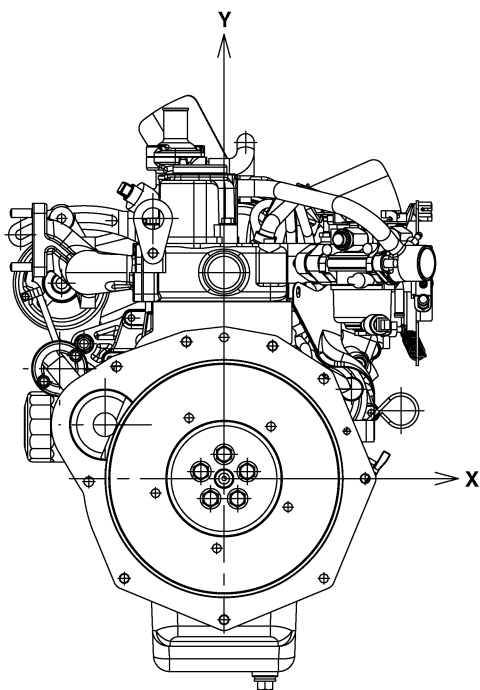
Model	Dry weight kg (lb)	Center of gravity		
		X mm (in)	Y mm (in)	Z mm (in)
WG752	61.7 (136)	2 (0.08)	64 (2.52)	171 (6.73)
WG/DG972	72 (159)	-25.5 (-1.00)	73.3 (2.89)	179.5 (7.07)

2. With SAE flywheel and flywheel housing

Model	Dry weight kg (lb)	Center of gravity		
		X mm (in)	Y mm (in)	Z mm (in)
WG752	89 (196.2)	1 (0.04)	47 (1.85)	188 (7.4)
DG972	95.4 (210)	-10 (-0.39)	28 (1.1)	207 (8.15)

■ **NOTE**

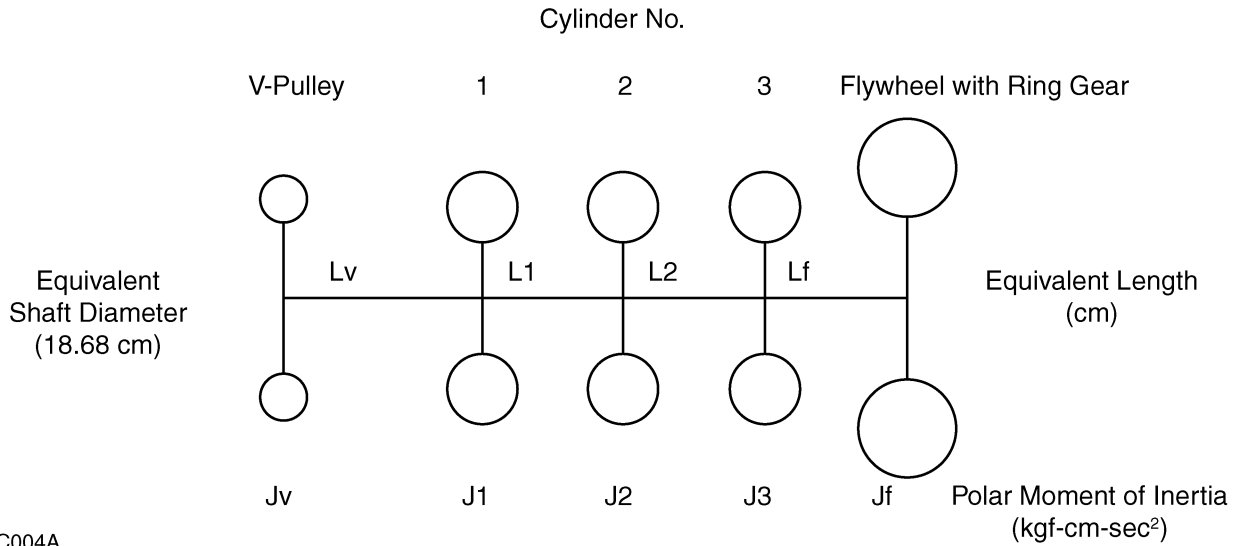
- Cooling water and lubricating oil weight is not included in above engine weight.



TEC003A

9. MASS ELASTIC SYSTEM

[1] EQUIVALENT TORSIONAL VIBRATION DATA



TEC004A

MODEL	EQUIVALENT LENGTH (cm)				POLAR MOMENT OF INERTIA (kgfcm-sec ²)				
	LV	L1	L2	Lf	JV	J1	J2	J3	Jf
WG752	30670	5136	5136	3673	0.013	0.017	0.011	0.018	0.392

■ **NOTE**

- Flywheel 16861-25110, V-Pulley 16861-74280

MODEL	EQUIVALENT LENGTH (cm)				POLAR MOMENT OF INERTIA (kgfcm-sec ²)				
	LV	L1	L2	Lf	JV	J1	J2	J3	Jf
WG/DG972	35082	4528	4528	2824	0.013	0.026	0.026	0.026	0.523

■ **NOTE**

- Flywheel EG511-25110, V-Pulley 16861-74280

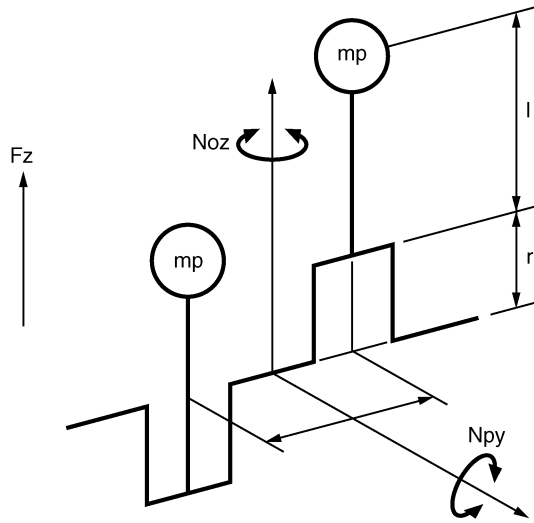
MODEL	EQUIVALENT LENGTH (cm)				POLAR MOMENT OF INERTIA (kgfcm-sec ²)				
	LV	L1	L2	Lf	JV	J1	J2	J3	Jf
DG972	35082	4528	4528	2824	0.013	0.026	0.026	0.026	1.281

■ **NOTE**

- Flywheel EG582-25110, V-Pulley 16861-74280

10. UNBALANCED FORCES

[1] BASE DATA



F_z : Unbalanced inertia force
 N_{py} , N_{oz} : Unbalanced inertia couple
 m_p : Reciprocating mass
 r : Crank radius
 l : Center distance of connecting rod
 L : Cylinder distance
 ω : Angular velocity
 $\frac{2\pi n}{60}$
 n : Engine speed min^{-1} (rpm)

TEC005A

Model	l (m)	r (m)	L (m)	Wp (kgf)	Bore (mm)	Stroke (mm)
WG752	0.0980	0.0340	0.0720	0.4320	68.0	68.0
WG/DG972	0.0980	0.0368	0.0800	0.3685	74.5	73.6

[2] UNBALANCED INERTIA FORCE AND COUPLE

($x\omega^2$)

Model	No. of Cylinder	Cylinder Bore (mm)	Order	Fz	Npy	Noz
WG752	2	68.0	1	0	0.000093	0.000093
			2	0	0.000065	0
WG/DG972	2	74.5	1	0	0.000096	0.000096
			2	0	0.000072	0

[3] AN EXAMPLE OF CALCULATION

Calculation condition	ω^2	Fz, Npy, Noz		
		Order	Calculation	
Engine model : WG752 Engine speed : 3600 min ⁻¹ (rpm)	$(2 \times \pi \times 3600/60)^2 = 142122$	Fz (kgf)	1	0
			2	0
		Npy (kgf-m)	1	$0.000093 \times 142122 = 13.2 \text{ kg}$
			2	$0.000065 \times 142122 = 9.2 \text{ kg}$
		Noz (kgf-m)	1	$0.000093 \times 142122 = 13.2 \text{ kg}$
			2	0
Engine model : WG/DG972 Engine speed : 3600 min ⁻¹ (rpm)	$(2 \times \pi \times 3600/60)^2 = 142122$	Fz (kgf)	1	0
			2	0
		Npy (kgf-m)	1	$0.000096 \times 142122 = 13.6 \text{ kg}$
			2	$0.000072 \times 142122 = 10.2 \text{ kg}$
		Noz (kgf-m)	1	$0.000096 \times 142111 = 13.6 \text{ kg}$
			2	0

Application Check Sheet

for **Kubota Small SI Engine**

Engine Model: _____ Code No. -	Basic Engine Model: _____ Code No. -
Overload: ___ kW(ps) ISO-2534,3046 / min ⁻¹ (rpm)	Overload: ___ kW(ps) ISO-2534,3046 / min ⁻¹ (rpm)
Continues: ___ kW(ps) ISO-2534,3046 / min ⁻¹ (rpm)	Continues: ___ kW(ps) ISO-2534,3046 / min ⁻¹ (rpm)
Idling Speed: High/ ~ min ⁻¹ (rpm), Low/ ~ min ⁻¹ (rpm)	
Application: _____	

Engine Engineering Dept.

KUBOTA Corporation

	Revision		Issued
_____,20	_____,20	_____,20	_____,20



confirmed Equipment Maker (Customer) _____ Your signature Date: / / 20	→ ←	Issue No. _____ KUBOTA (Engine) Distributor _____ Your signature Date: / / 20	↑ ↓ ↑ ↓	Reg.No. _____ KUBOTA Corporation _____ Manager Engine Engineering Dept.		
<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">KUBOTA Corporation</td> </tr> <tr> <td style="padding: 5px;">Manager Engine Global Marketing Dept.</td> </tr> </table>					KUBOTA Corporation	Manager Engine Global Marketing Dept.
KUBOTA Corporation						
Manager Engine Global Marketing Dept.						

1) Purpose :

One of the policies of KUBOTA Corporation Engine Division (hereinafter referred as “KUBOTA”) is to assist equipment manufacturers in the application of KUBOTA engines with the objective of improving the overall equipment quality. One of the methods used to achieve this objective is the review, testing and documentation (Installation Review) of an engine installation with the equipment manufacturer.

Customer satisfaction is directly related to the proper engine application in the end equipment. It is important to obtain the best possible installation in all equipment / applications to insure repeat sales, optimum equipment reputation and reduced warranty claims.

KUBOTA is responsible for performing Engine Application Review for KUBOTA direct OEM and KUBOTA Distributors are responsible for Distributor OEM and retail applications respectively. In case KUBOTA Distributors request KUBOTA the supply of OEM Specified Engine, completed Engine Application Review forms should be sent to KUBOTA Engine Engineering Dept. via KUBOTA Engine Global Marketing Dept.. KUBOTA Engine Engineering Department will review and inform the registration number will comments to KUBOTA Distributors via KUBOTA Engine Global Marketing Dept.

Improper application or installation without a registered Application Review can result in denial of warranty.

2) Application Review Forms :

Following forms are used for KUBOTA to review its Direct OEM product. KUBOTA Distributors are recommended to use the same forms for the review.

This check sheet describes only 'B-1', 'b-2' and 'b-3' that should be checked specially for Small SI Engines.

Please use the Application Check Sheet for Diesel Engines, together.

•Review Form - (a) :

- Engine Application Sheet 1/3 : required technical factors and environmental conditions in installation (A-1)
- Engine Application Sheet 2/3 : power requirement as per each PTO system and engine model recommendation (A-2)
- Engine Application Sheet 3/3 : product type, engine mounting system and other technical informations (A-3)

- Engine Performance, Maintenance and Safety Check Sheet (B-1) for Small SI Engines

- Engine Specification Sheet (B-2---1/2, 2/2)

•Review Form - (b) :

- All of the “Review Form - (a)” sheets and
- Engine Operation Measuring Data Sheet (b-1)
- Temperature Measuring Sheet (b-2) for Small SI Engines**
- Vibration Measuring Sheet (b-3) for Small SI Engines**

- New part of Modification Request and Part Change Information & Agreement Sheet (C-1), (C-2)

3) Supplement :

The purpose of this application review is, as mentioned in the paragraph 1), to assist equipment manufactures in the application of Kubota engines with the objective of improving overall equipment quality. In this object, Kubota and the Kubota distributors assume no and hereby disclaim any additional liability in undertaking this review, including but not limited to, any liability under any express or implied warranties, applicable national, state or local laws, regulations or ordinances, or otherwise. The customer is responsible for accurately and fully completing this engine application review and returning it to Kubota or the Kubota distributors, as the case maybe.

The customer is further responsible for confirming the suitability for different operating conditions or legal regulations and requirements at each delivery destination.

B -1 Performance & Maintenance and Safety Check Sheet for Small SI Engines

Unit model / serial no. :	Product Name :
Engine Model :	Engine serial no. :
Checked place at :	Loadng condition :

checking items	judged	checking items	judged
1. Engine oil :		- fuel pipe's contact with hot part	
Oil temp. (below 120 °C (248 °F) under max load and below 110 °C (230 °F) at continuous operation)		- fuel pipe's contact with engine or machine	
- oil level checking		- caution label on fuel type and fire	
- oil supply		- temperature of fuel system must not beyond 53 °C or 127 °F	
- oil draining		- certified fuel system for evaporative emission standards	
- oil filter replacement		- fuel tank capacity (less than 80L or 21.1gal (us))	
		- temperature of fuel in the fuel tank (less than 53 °C or 127 °F)	
		- canister capacity if used (appropriate to the fuel tank)	
2. Cooling system		- liquid gasoline flow to the canister	
- obstacles, radiator front and rear		- fuel draining from carburetor	
- clearance, fan and radiator core / shroud		- length of LPG hose for vaporizer (300 ± 20mm or 11.8 ± 0.78 inch)	
- prevention of re-circulation cooling air		- installation direction of vaporizer	
- prevention dust of radiator		- vacuum lock hose	
- checking, closed by dust on radiator		5. Electric parts	
- capacity (radiator locally supplied)		- temp. (unexposed to elevated heat)	
- antifreeze coolant		- fixing direction	
- reserve tank		- protection from rain, vibration	
air to boil (ATB = above 49 °C (120 °F), at continuous operation)		- key switch, prevented from rain, washing	
- water supply and level checking		- earth (two earth connections necessary for rubber cushion mount)---Battery ↔ Engine / Battery ↔ Chassis	
- water draining		- preventive measures against improper wire connection of ignition harness	
- fan belt adjustment		- battery capacity	
- fan best replacement		- battery check, cleaning, replacement	
- danger of scald by overblown hot water		- battery cord has a structure not connected conversely	
- danger of scald by damages of radiator cap, Hoses		- battery cord not bundled other cords	
		- contact parts, covered by corrugate tube	
		- wiring clipping, suitable for vibration	
		- engine stop at shut down of electric circuit (e.g. Battery dropped out)	
		- alternator L-terminal load > 5mA, when short circuit protector is adopted.	
		- Do NOT connect relay with alternator L-terminal when short circuit is not adopted	
3. Inlet and Exhaust		6. Others	
- "Exhaust Emission Check Sheet" agreement		- no excessive force on engine speed control lever	
- entrance of rain, dust and hot air from air cleaner		- no resonance point between low and high engine Operation	
- capacity (locally supplied air cleaner)		- engine oil, specified oil is used	
- back pressure of muffler (locally supplied muffler)		- cold starting ability, satisfactory for customer Requirement	
- check, cleaning and replacement of air cleaner Element		- PTO system, proper	
- objects, easy burn, on or over muffler		- side PTO, correct	
- exhaust direction (not toward human being, battery, fuel system)		- belt tension drive, durable	
- cover to prevent a burn		- engine serial number, can be read	
- entrance of water from the exhaust exit by rain and washing		- engine maintenance interval, clarified	
- cover to prevent water, stone, etc (catalyst parts)		- guard for rotating	
- position, combination with exhaust manifold (catalyst parts)		- cover at high temp. Parts / area for burn prevention	
		- safety label	
4. Fuel system		- speed control through Kubota speed control lever and/or governor lever	
- filter at fuel tank, supply port		- emission level are visible on the machine	
- waved fuel piping, fuel drop to fuel tank			
- air bleeding, after fitter change or fuel empty			
- electric fuel feed pump for low positioned tank			
- fuel supply to fuel tank			
- fuel draining from tank bottom			
- air bleeding from fuel line			
- check, cleaning, replacement of fuel filter			

note : judgment (evaluation) : O = good, OK, E = to be examined, X = No good, need modification.

* If there are specification or structural changes at Customer's product, application must be rechecked and reported.

confirmed

Customer : _____ Distributor : _____ KUBOTA : _____

b-2 Temperature Measuring Sheet for Small SI Engines

Unit model / serial no. :	Product Name :	checked place at :
Engine model :	Engine serial no. :	Loading condition :

	measuring	before	1st	2nd	3rd	4th	5th	6th	7th	8th	standard value of evaluation	remarks
		E/G start	1st	2nd	3rd	4th	5th	6th	7th	8th		
* measuring started time :		°C/°F	°C/°F	°C/°F	°C/°F	°C/°F	°C/°F	°C/°F	°C/°F	°C/°F	°C/°F	
* measuring stopped time :		°C/°F	°C/°F	°C/°F	°C/°F	°C/°F	°C/°F	°C/°F	°C/°F	°C/°F	°C/°F	
(unit = degrees °C/°F)												
1. Atmosphere	AT											
2. Engine room	RT										<75/167	
3. Exhaust gas (together)	EXT											
4. Engine oil	LOT										<110/230	(at Continuous) (at Overload)
	ΔT										<120/248	
5. Air intake	IAT										<45/113	(IAT)-(AT)
	ΔT										<5/9	
6. Cooling air inlet	CAIT										<40/104	
7. Cooling air outlet	CAOT											(CAOT)-(CAIT)
	ΔT										<30/54	
8. Cooling water inlet ®	CWIT										<110/230	**radiator cap = 0.9 kgf/cm ²
9. Cooling water outlet ®	CWOT											
10. Air To Boil												
***ATB=(x)-(CWIT)+(AT)	ATB										>55/131	(at Max.load)
11. Overflow volume of cooling water	OFQ											
12. Fuel	FOT										<60/140	(FOT)-(AT)
	ΔT										<20/68	
13. Carburetor chamber surface	ΔT										<20/68	(FOT)-(AT)
14. Battery surface	BRT										<55/131	(CCT)-(AT)
15. surface of starter, alternator, regulator, etc.	STT										<80/176	
	ALT											
	RET											
16. Surface of ignitor, IGcoil	SIT										<80/176	
17. Engine rotation min ⁻¹ (rpm)											Low Idling	
	N										High Idling	

note : 1) **Operating conditions : Cooling water / LLC 50%, Thermostat / jacked open.**

2) The above judgment (evaluation) standards is to be applied in the max. ambient condition of 40°C (104°F), in case that the ambient temperature is over 40°C (104°F), it must be judged adding the balance between the actual temperature and 40°C (104°F) to the judgment standard.

3) **Do not run a cooling test if the ambient temperature is below 24°C (75°F) because the large change in air density and radiation from non cooling system parts give false results.**

***Air To Boil (ATB) value must be calculated by using below max. temperature :

LLC 50% with 88.3 kPa (0.9 kgf/cm² or 12.8 psi) pressure cap : (x) = 110°C (230°F)

special note :

1) The judgment standard > 49°C (120°F) in the above formula { ***ATB = (x) - (CWIT) + (AT) } is KUBOTA's standard. It may change depending on applications, countries, locations, etc., therefore, it is better to judge under the discussion with OEM's referring their own experienced values.

Agreement :

*** If there are specification or structural changes at Customer's product, application must be rechecked and reported.**

confirmed

Customer : _____

Distributor : _____

KUBOTA : _____

reported by : _____

b-3 Vibration Measuring Sheet for Sheet SI Engines

Unit model / serial no. :	Product Name :	checked place at :
Engine model :	Engine serial no. :	Loading condition :

direction (rotation)→	vibrating acceleration RMS*** (G)				total amplitude (mm)				result	
	standard value of evaluation	4/4 full load min ⁻¹ (rpm)	0/4 No load min ⁻¹ (rpm)	(resonance point) min ⁻¹ (rpm)	standard value of evaluation	4/4 full load min ⁻¹ (rpm)	0/4 No load min ⁻¹ (rpm)	(resonance point) min ⁻¹ (rpm)	good OK	No good to be modified
1. Crank case										
up / down	8(10)				0.7(1)					
forward / rear	↑				↑					
left / right	↑				↑					
2. Radiator										
up / down	2(3)				0.5(1)					
forward / rear	↑				↑					
left / right	↑				↑					
3. Muffler										
up / down	5(10)				0.7(1)					
forward / rear	↑				↑					
left / right	↑				↑					
4. Air cleaner										
up / down	5(10)				0.7(1)					
forward / rear	↑				↑					
left / right	↑				↑					
5. Fuel filter										
up / down	5(6)				0.7(1)					
forward / rear	↑				↑					
left / right	↑				↑					
6. Fuel tank										
up / down	7(10)				0.7(1)					
forward / rear	↑				↑					
left / right	↑				↑					
7. Carburetor										
up / down	5				0.7(1)					
forward / rear	↑				↑					
left / right	↑				↑					
8. Vaporizer										
up / down	5(10)				0.7(1)					
forward / rear	↑				↑					
left / right	↑				↑					
9. Starter										
up / down	5(10)				0.7(1)					
forward / rear	↑				↑					
left / right	↑				↑					
10. Dinamo / Alternator										
up / down	5(10)				0.7(1)					
forward / rear	↑				↑					
left / right	↑				↑					
11. IG coil										
up / down	5(10)				0.7(1)					
forward / rear	↑				↑					
left / right	↑				↑					
12. Electric parts like Regulator, Lamp timer etc. and others										
up / down	2(3)				0.5(1)					
forward / rear	↑				↑					
left / right	↑				↑					

note : 1) "forward / rear" is crankshaft direction and "left / right" is a right angle direction for crankshaft.
 2) Figure () in the judgment column shows max. value of resonance point where passed by temporally.
 3) RMS*** : root mean square value.

special note : _____

*** If there are specification or structural changes at Customer's product, application must be rechecked and reported.**

confirmed

Customer : _____ Distributor : _____ KUBOTA : _____

reported by : _____

Exhaust Emission Check Sheet

for **Kubota Small Spark Ignition Engine**

Engine Model: Code No. _____ - _____	Base Engine Model: Code No. _____ - _____
Idling Speed: High/ _____ min ⁻¹ (rpm), Low/ _____ min ⁻¹ (rpm)	
Application: _____	

Engine Engineering Dept.

KUBOTA Corporation

Revision			Issued
Date : _____	Date : _____	Date : _____	Date : _____

confirmed

Issue No. _____

Rev.No. _____

Equipment Manufacturer
(Final Assembler)
"Company Name"
Name : _____
Title : _____
Signature : _____
Date : _____

KUBOTA Corporation
Engine Engineering Dept.
Name : _____
Title : General Manager
Signature : _____
Date : _____

↑ ↓

↑ ↓

KUBOTA(Engine)Distributor
"Company Name"
Name : _____
Title : _____
Signature : _____
Date : _____

"Sales Office Name"
Name : _____
Title : _____
Signature : _____
Date : _____

KUBOTA Corporation
Engine Global Marketing Dept.
Name : _____
Title : General Manager
Signature : _____
Date : _____

→
←

→
←

KUBOTA Industrial Engine Exhaust Emission Review

1. Purpose :

KUBOTA Corporation (KUBOTA) has established this policy for our products with all emission related parts installed (certified configuration) to comply with the applicable emissions regulation of which the equipment manufacturer sell their products to. This Exhaust Emission Check Sheet is to ensure the final certified configuration including emission related parts which to be installed by the equipment manufacturer, for KUBOTA to confirm such configuration to be in compliance with the applicable standards for the final destination of the equipment, and to establish the configuration between the equipment manufacturer and KUBOTA via Kubota Sales Office.

Additionally, if the engine listed in this check sheet was to be exported to U.S. and Canada in uncertified configuration, it would be exempted from the applicable regulation according to 40 CFR Part 1068.261 provided that such engine will be in the final certified configuration when installed in the equipment based on the contractual agreement. This check sheet serves as Appendix 1 of the contractual agreement package with the purpose for the final assembler to agree to bring the engine into the final certified configuration.

<NOTE>

Make sure to contact KUBOTA via Kubota Sales Office before any parts related to delegated assembly listed in this check sheet are to be changed if the engine is possibly exported to U.S.. Upon mutual agreement of the contents of the change, then perform the change. Failure to do this may be subject to the violation of the paragraph (k) of 40 CFR Part 1068.261.

2. Summary of Exhaust Emission Check Sheet

(1) Emission Performance Check Sheet

- Equipment Information
- The List of Adopted Parts for Intake, Fuel, and Exhaust System
- Emission Performance Result

(2) Fuel System Specification and Intake System Specification Check Sheet

- Details of Installation of Fuel System Specification and Intake System Specification
- * As for dedicated OEM specification engine model (the engine with emission related parts not included in the Installation Instruction Manual), this check sheet also serves as the installation instruction manual.

(3) Exhaust System Specification Check Sheet

- Details of Installation of Exhaust System Specification
- * As for dedicated specification engine model (the engine with emission related parts not included in the Installation Instruction Manual), this check sheet also serves as the installation instruction manual.

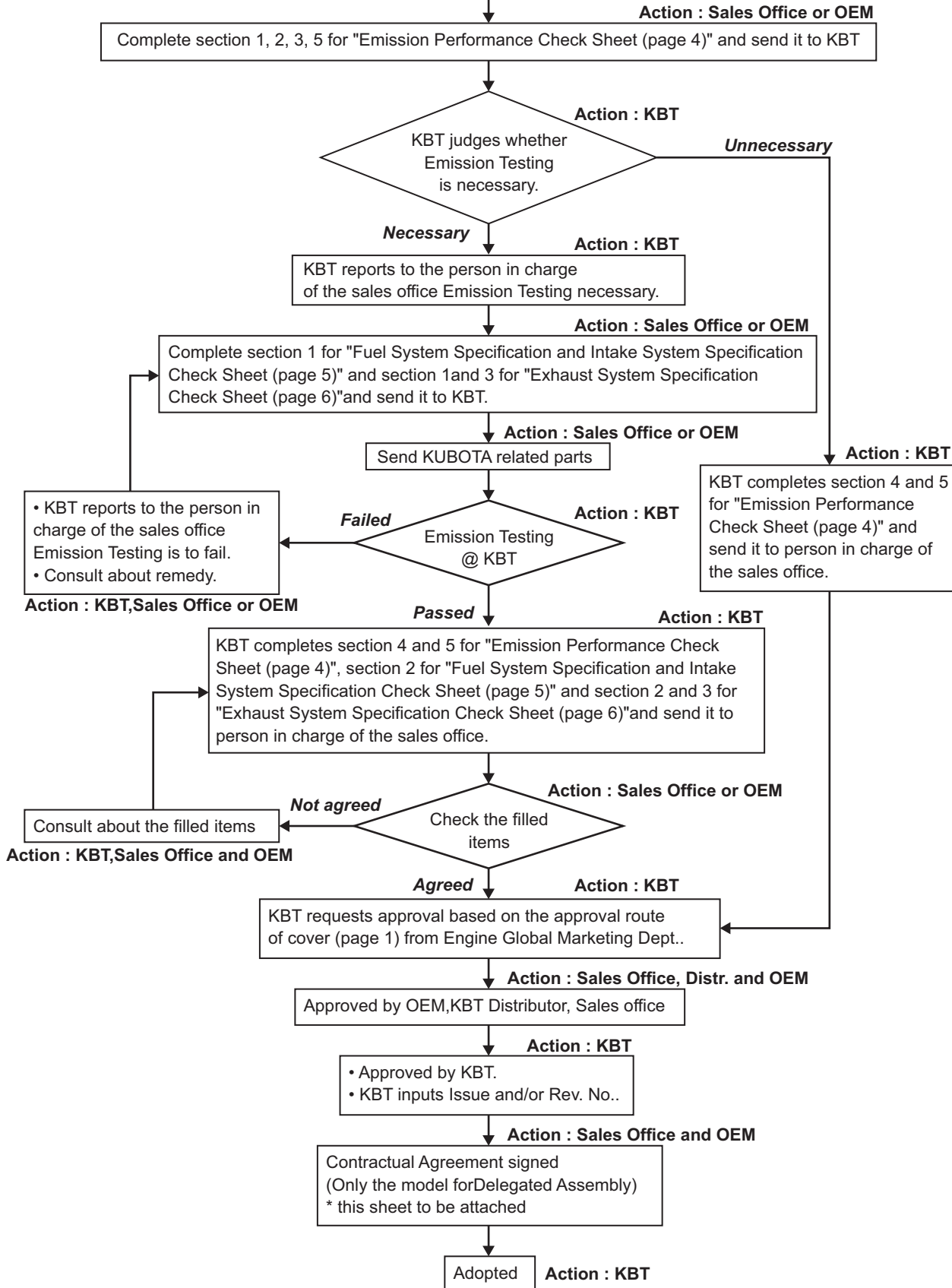
Flow Chart

Action : Sales Office or OEM

Non-intake System Emission Related Parts Selection

- Exhaust manifold: Select from KBT approved parts
- Cat converter/muffler: Select from KBT approved parts
- Spacer: Required or not. (If required, meet the requirements provided in the installation instructions.)
- Gas hose (LPG/NG fueled engine only): Length must be 300 +/- 20mm.

Intake System Emission Related Parts Selection



Emission Performance Check Sheet

(Category: Engine Displacement Less than 1 Liter)

1. Final assembler Information

Final assembler's Name : _____
 Equipment Model Name : _____

2. Subject Regulations and Fuels (Mark "X" or Check the box(es) below)

Regulations : EPA CARB 2002/88EC CANADA other : "Fill in the name of regulation"
 Fuels : Gasoline LPG Natural Gas _____

3. Engine Information (Fill when adopted)

Engine Model Name : _____ Engine Code : _____

3.1 Fuel System and Intake System Specification

For OEM specific engine, attach the drawing or the photo which shows the status of installation on page 5.

Part Name	KUBOTA p/n	OEM p/n	Delegated Assembly*	Remarks
Carburetor				select from KBT approved parts
Throttle Body				select from KBT approved parts
Mixer				select from KBT approved parts
Air Cleaner Flange				select from KBT approved parts
Inlet Hose 1				Hose between Air Cleaner flange and Air Cleaner
Inlet Hose 2				
Inlet Hose 3				
Air Cleaner				
Air Cleaner Hose 1				Hose to attach Air Cleaner inlet
Air Cleaner Hose 2				
Air Cleaner Hose 3				
Gas Hose				Hose to attach between mixer, vaporizer, and regulator *Length: Must be 300+/-20mm

*Final assembler to mark "O" to the parts to install.

3.2 Exhaust System Specification

For specification engine model, attach the drawing or the photo which shows the status of installation on page 6.

Part Name	KUBOTA p/n	OEM p/n	Delegated Assembly*	Remarks
Spacer				comply with installation instruction
Catalytic Converter				select from KBT approved parts
Catalytic Muffler				select from KBT approved parts

*Final assembler to mark "O" to the parts to install.

4. Emission Performance Result

TO BE COMPLETED BY KUBOTA

Test Location : _____ Test Date : _____
 Engine Serial No. : _____ Test Mode : _____

4.1 Test Result

(Passed: OK, Failed: X, Not Subject: -)

	Standard	Gasoline	LPG	Natural Gas
HC+NO _x	≤ g/kWh			
CO	≤ g/kWh			

* If there are Intake, Fuel or Exhaust system changes at Customer's Product, Emission of application must be rechecked.

5. Reporter

Reporter (Items 1 ~ 3) : _____ Date : _____
 Reporter (Item 4) : _____ Date : _____

Fuel System Specification and Intake System Specification Check Sheet

<1. Fuel system picture or drawings and intake system specification installation details.>

<2. Assembly Procedure> To be filled by KUBOTA.

* If there are Intake, Fuel or Exhaust system changes at Customer's Product, Emission of application must be rechecked.

Exhaust System Specification Check Sheet

<1. Exhaust system specification installation details.>

<2. Assembly Procedure> To be filled by KUBOTA.

* If there are Intake, Fuel or Exhaust system changes at Customer's Product, Emission of application must be rechecked.

3. Reporter (Fuel system, intake system, exhaust system specification confirmation sheet)

Reporter (Item 1) : _____ Date : _____

Reporter (Item 2) : _____ Date : _____

Kubota Emissions-Related Installation Instructions

CARB/EPA certified engines, WG752 & WG972

The instructions in this document supersede any other previous instructions provided by Kubota

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1. Important Notice

EMISSION-RELATED INSTALLATION INSTRUCTIONS

These instructions are provided for the final engine assemblers who must ensure the engine, exhaust system (catalyst), intake system, gasoline fuel system etc, are Installed correctly in the engine's certified configuration.

Failing to follow these instructions when installing a certified engine in a piece of non-road equipment violates federal law (40CFR 1068. 105 (b)), subject to fines or other penalties as described in the Clean Air Act.

2. About Objective Items

1. Intake System

- Kubota offers a standard Air-cleaner kit. The intake parts should be installed according to this instructions. If you use an OEM intake system for a spec engine, consult Kubota before the application review. You should consult Kubota whenever you change the intake system.

2. Exhaust System

- Kubota offers certified catalytic mufflers and catalytic converters. You must only use Kubota certified catalyst parts and assemble the exhaust parts according to the instructions. Catalyst parts other than Kubota must not be used because other catalyst is not certified for these engines. You must consult Kubota when you change the exhaust parts after application review.

3. High Altitude Operation

- Kubota prepared genuine altitude compensation kit. The ultimate users must comply with the regulations through the installation of the appropriate altitude compensation kit.

4. Evaporative Emission Controls

- If your equipments use a volatile liquid fuel (such as gasoline), they must meet the evaporative emission standards of 40 CFR part 1060, as described in §1054.112.

5. Engine Set Speed

- You should operate the engine within the range of engine speed range set at the time of Kubota shipment.

6. Engine Labels

- Kubota puts the certification label on the cylinder head cover. If you install the engine in way that makes the engine's emission control information label hard to read during normal engine maintenance, you must place a duplicate label on the equipment, as described in 40 CFR 1068.105.

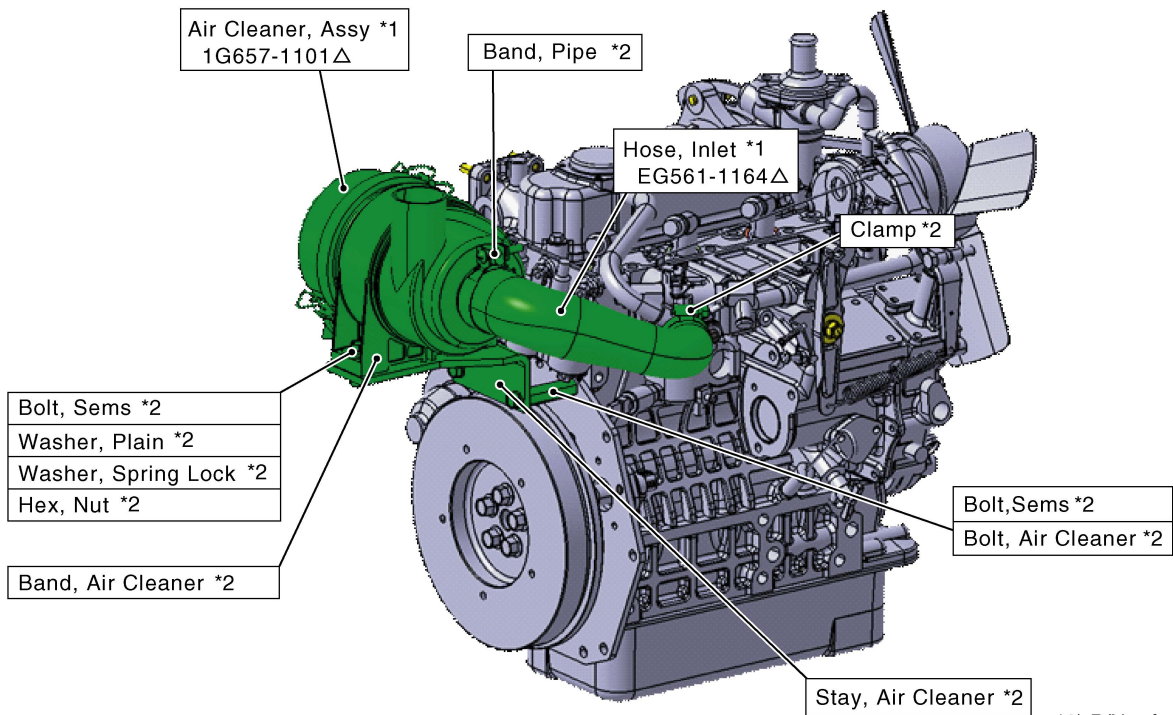
7. Vaporizer Connections

- The hose length between the vaporizer and carburetor must be within 300 ± 20 mm (11.8 ± 0.78 inch).

[1] Air Intake System

- Intake system means that layout of all parts from entrance of suction to air-cleaner flange.
 - Kubota offers standard Air-cleaner kit. See SOS option manual about selectable Air-cleaner kit.
 - The intake parts should be installed according to these instructions.
 - If you use an OEM intake system for a spec engine, consult Kubota based on the Exhaust Emission Check Sheet before the application review.
 - When the same specification engine is installed on multiple applications, you will have to inform Kubota prior to the application review.
Also, the final intake system of each application must be confirmed at the application review and/or the Exhaust Emission Check Sheet.
You must install the intake system confirmed at the application review and/or the Exhaust Emission Check Sheet.
- [Check Item]**
- You should consult Kubota based on the Exhaust Emission Check Sheet whenever you change the intake system.
Do not change without consultation with Kubota.

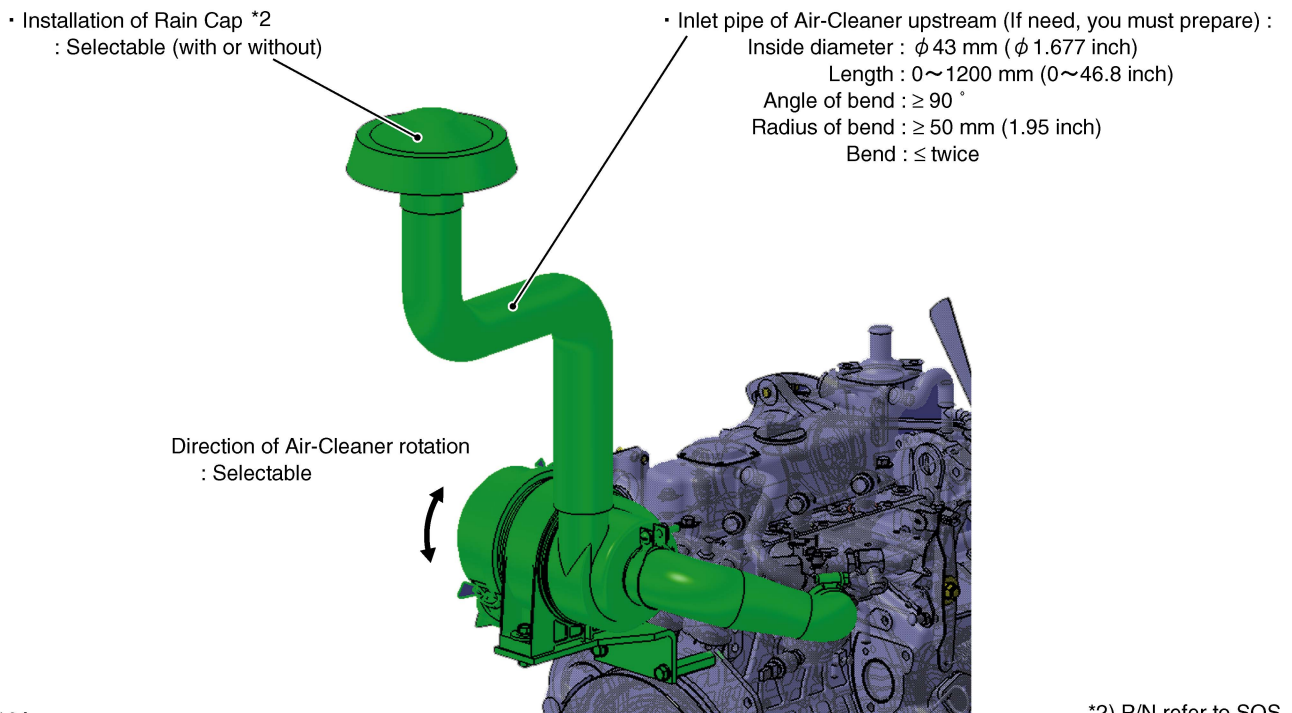
- External view with standard kit.
Kit parts with “*1” must be installed as shown in the figure below.



EMI014A

*2) P/N refer to SOS

- Exception
The figure below shows the range of the layout that you can select freely for the standard kit.



EMI016A

*2) P/N refer to SOS

[2] Exhaust System

- Exhaust system means the layout of all parts from exhaust manifold to exhaust exit to atmosphere.
- Kubota offers certified catalytic mufflers and catalytic converters.
You must only use Kubota certified catalyst parts [Check Item] and assemble the exhaust parts according to these instructions and/or the Exhaust Emission Check Sheet.
Catalyst parts other than Kubota must not be used because other catalyst is not certified our engine.
You must install the exhaust system confirmed at application review and/or the Exhaust Emission Check Sheet.
[Check Item]
- You must consult Kubota based on the Exhaust Emission Check Sheet when you change the exhaust parts after application review. Do not change without the consultation with Kubota.

- Catalyst Identification Marks

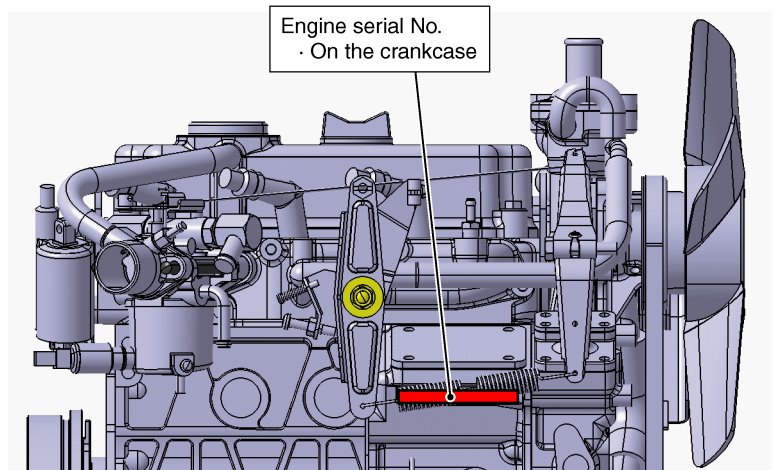
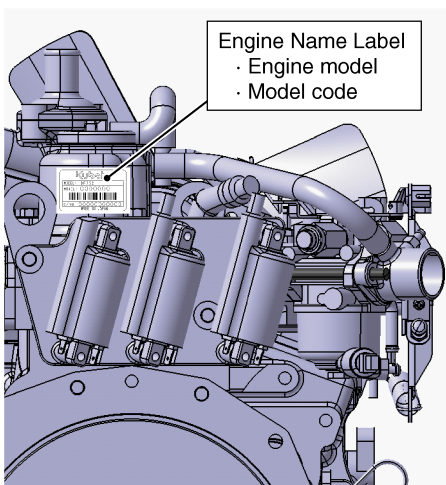
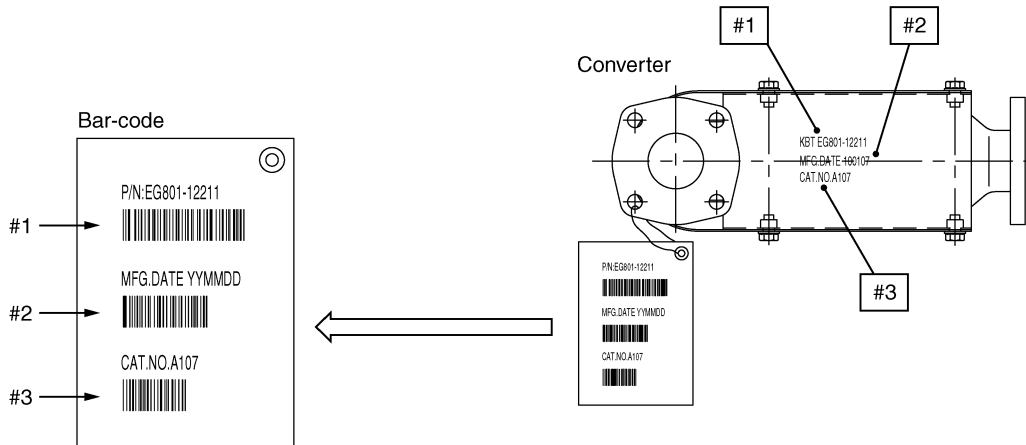
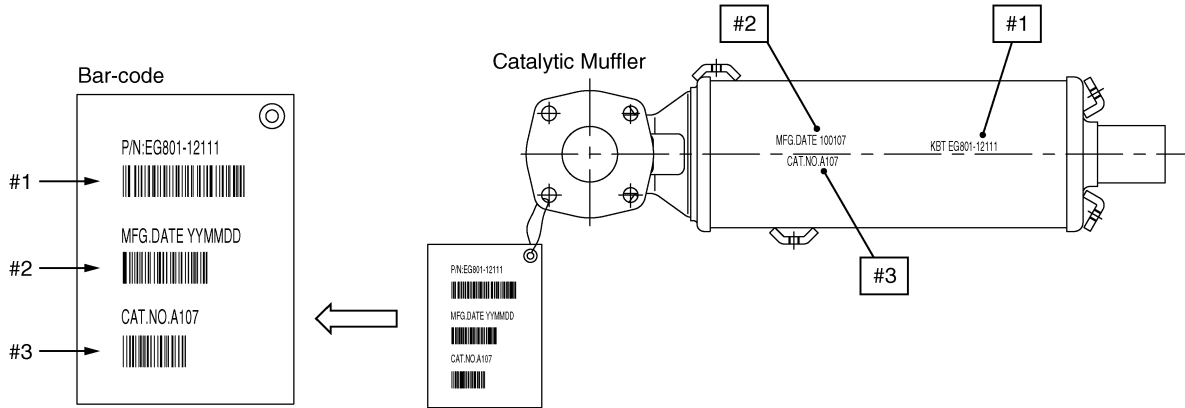
The manufacturing number and the catalyst number are marked on surfaces of the catalyst parts.

You must keep record of the catalyst identification information with the engine model and engine serial number that the catalyst is installed. **[Check Item]** The catalyst parts are shipped with bar-code identification information.

#1 Part number

#2 Manufacturing number

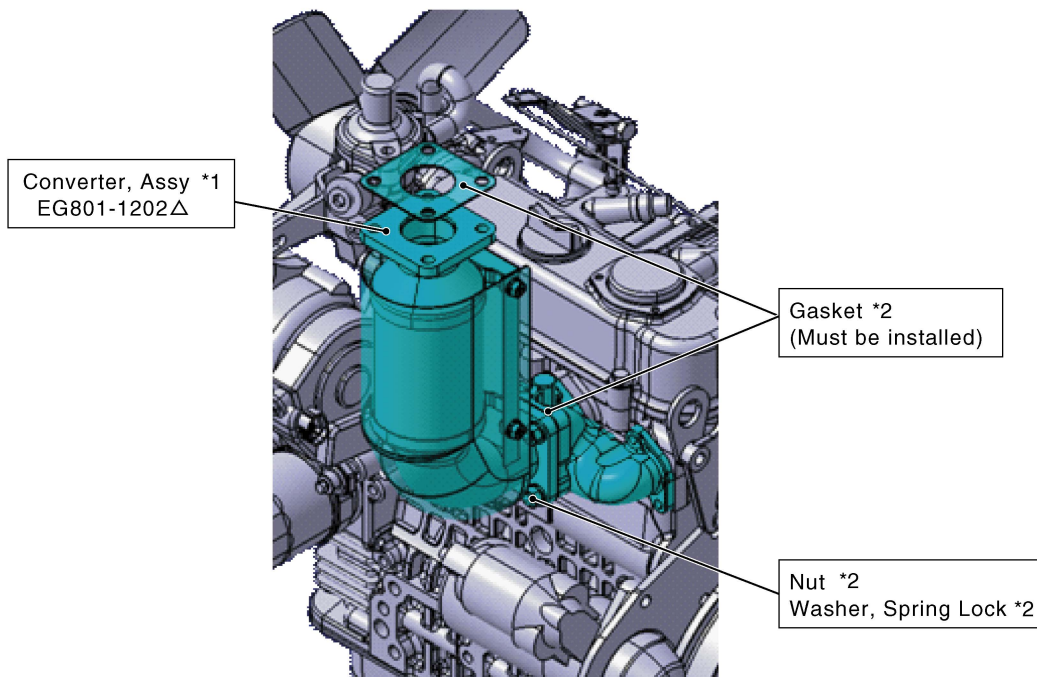
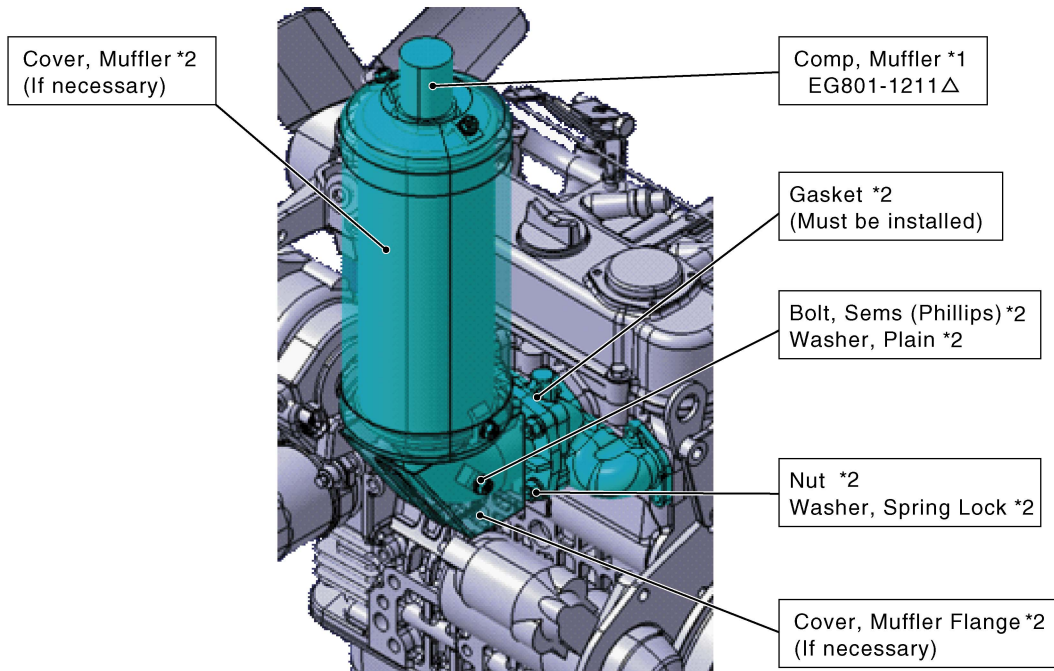
#3 Catalyst number:



EXH007A

- You must install the catalyst parts with “*1” directly to the exhaust manifold through the gasket.
See SOS option manual about selectable combinations of the catalyst parts and the exhaust manifold.
- When you use the converter, you must install the converter in the direction where the elbow side of the converter is attached to the exhaust manifold.
- Tighten with the specified torque 23.5~27.5 N·m (17.33~20.28 lb-ft) to avoid exhaust gas leak.
(Exhaust Manifold, Catalyst) **[Check Item]**
- Handle catalyst parts with care. Damaged or catalyst that has been ‘dropped’ cannot be used.

External view of standard engine



- Exceptions
 - When it is necessary to offset the installation positions of the catalyst parts to avoid part interference or etc, a spacer can be used between the exhaust manifold and catalyst parts.

[Only for WG972]

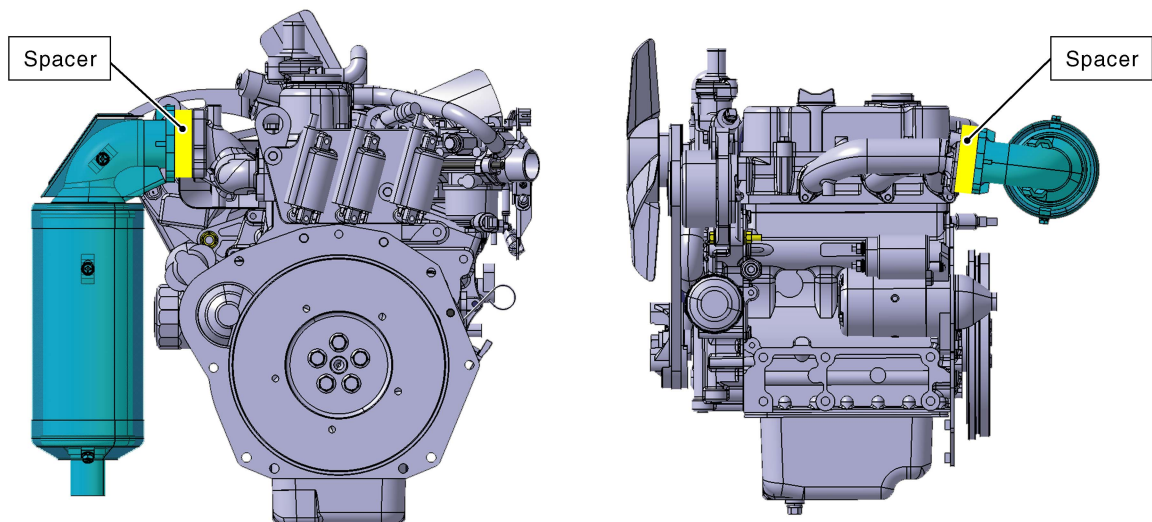
Allowable max thickness of the spacer is **20 mm (0.78 inch)**. **[Important]**

[Only for WG752]

Allowable max thickness of the spacer is **13 mm (0.51 inch)**. **[Important]**

[Check Item]

- Kubota gasket must be installed on both sides of the spacer.
- The surface-roughness of both Sides of the spacer must be less than 3.2a (3.2 μm).
And allowance of levelness must be less than 0.2 mm.
- The material of the spacer must be corresponding of SPHC.
- Tighten torque must be within 23.5~27.5 N·m (17.33~20.28 lb·ft)
- When change the stud on the exhaust manifold or use the bolt to tighten, the material of the stud and the bolt must be SAE10B23H.
- Refer to SOS option manual for the installation pitch and etc. of exhaust manifold and catalyst parts.



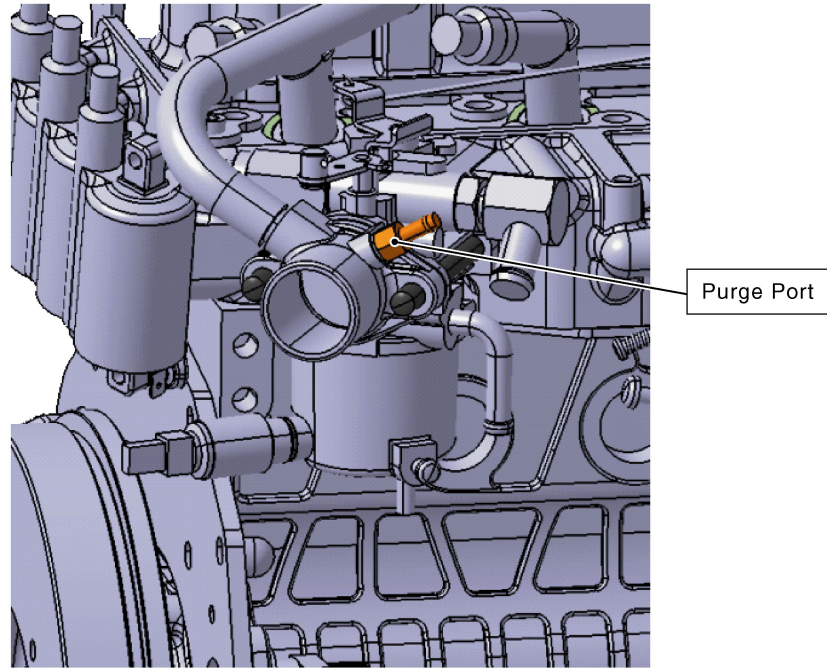
EXH003A

[4] Evaporative Emission Controls

See the evaporative emission standards specified for your equipment in 40 CFR 1054.112 and CARB section 2754. **[Check Item]**

The standards and other requirements in 40 CFR part 1060 apply to the fuel lines, fuel tanks, fuel caps, canisters and others used or intended to your equipments and our engines.

- Nonmetal fuel lines must meet the permeation requirements specified in 40 CFR 1060.102.
- Fuel tanks must meet the permeation requirements specified in 40 CFR 1060.103 unless they are installed in equipment certified to meet diurnal emission standards under 40 CFR 1060.105(e).
- Your equipment must have a tethered fuel cap. Fuel caps must also include a visual, audible, or other physical indication that they have been properly sealed (EPA 40 CFR 1060.101(f)(1)(i), CARB section 2756).
- Your equipment must have proper carbon canisters that are installed on the fuel tanks subject to running loss or diurnal emission standards (EPA 40 CFR 1060.104(b)(1), CARB section 2754).



EMI022A

KUBOTA recommendation

	Objective parts	Regulation requirements	Remarks
Equipment manufactures	Fuel Hose, Fuel Tank, Tank Cap, Canister	Use certified parts	40 CFR 1054.112 CARB section 2754
KUBOTA (engine)	* purge port	Add the purge port	

* To route running evaporative emissions into the engine intake system, Kubota prepared the purge port on the air-cleaner flange. You may use this purge port to combust fuel vapors vented from the fuel tank. **[Check Item]**

[Other Check Items]

You must confirm that the fuel parts layout is consistent with what was tested at the application review.
Please confirm the following items.

- Installation of heat cover, fuel hose, etc.
- The temperature of the fuel in the fuel tank must be less than temperature to prevent fuel boiling at all operating conditions.
- If you use a carbon canister, the capacity of fuel tank and the carbon canister is confirmed.
- The liquid gasoline does not enter from the fuel tank to the evaporative canister at all operating conditions. (at inclination, volume expansion by heat, surface level difference by vibration and etc).

■ NOTE

- It is equipment manufacturer's responsibility to make sure the fuel system will comply with the applicable evaporative emissions regulation.
- It is equipment manufacturer's responsibility to test and confirm the evaporative system will not cause engine performance issues at any operating condition.

[5] Engine Set Speed

[Mechanical Governor specification]

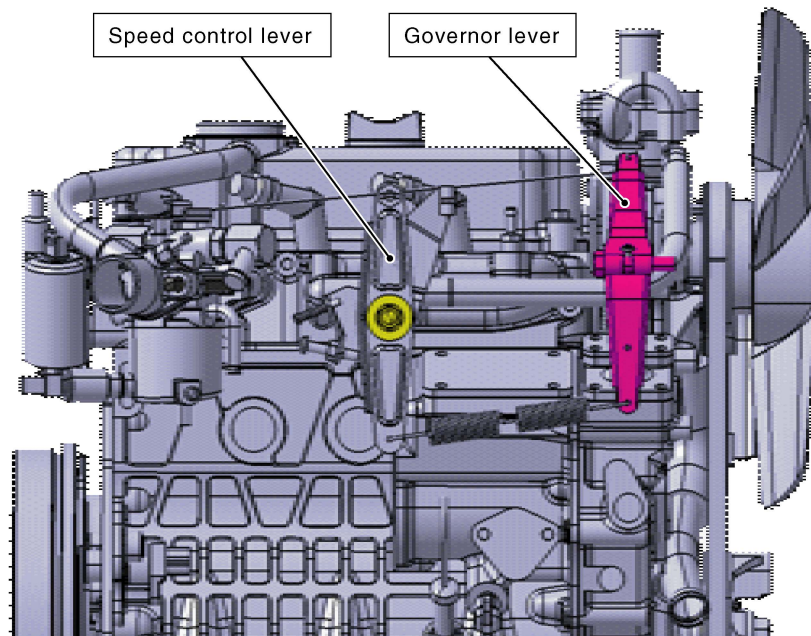
- You should operate the engine within the engine speed range set at the time of Kubota shipment (without parasitic load).
- You should use the speed control lever and/or the governor lever to change engine speed.

Standard engine speed set of
Kubota shipment (reference).

Low Idle : 1500 ± 100 rpm

High Idle : 3850^{+100}_0 rpm

Rated Speed : 3600 rpm



EMI023A

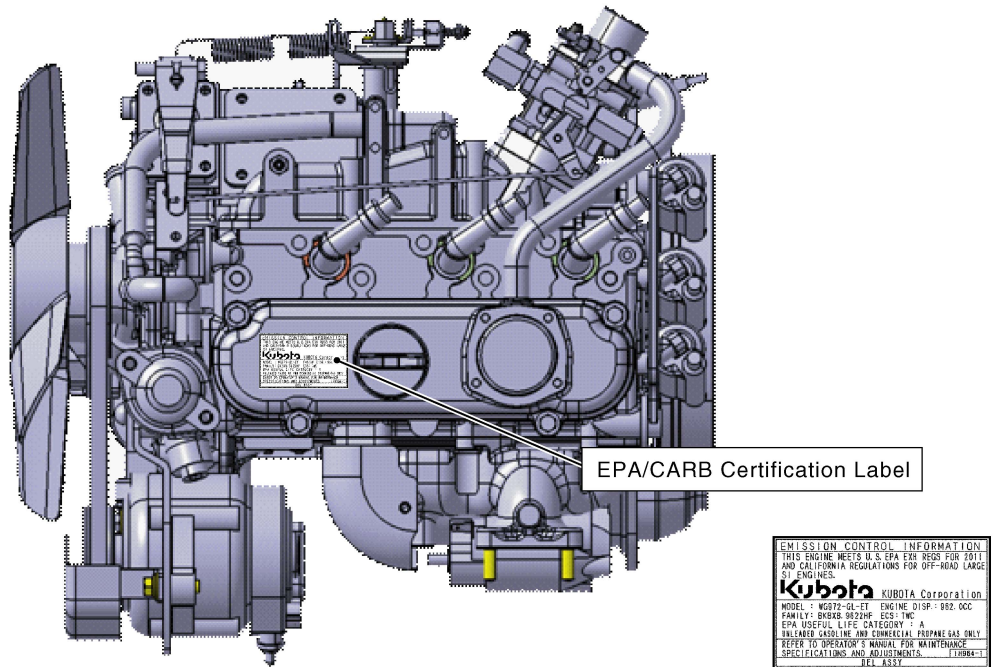
[Electronic Governor specification]

- If you use the electronic governor, consult KUBOTA before the application review.

[6] Certification labels

The following labels must be visible. If you install the engine in a way that makes the engine emission control information label hard to read during normal engine maintenance, you must place a duplicate label on the equipment, as described in 40 CFR 1068.105.

- EPA/CARB certification label part numbers
1H965-8891 Δ : WG972-G
1H964-8891 Δ : WG972-GL
1H963-8891 Δ : WG752-G
1H962-8891 Δ : WG752-GL

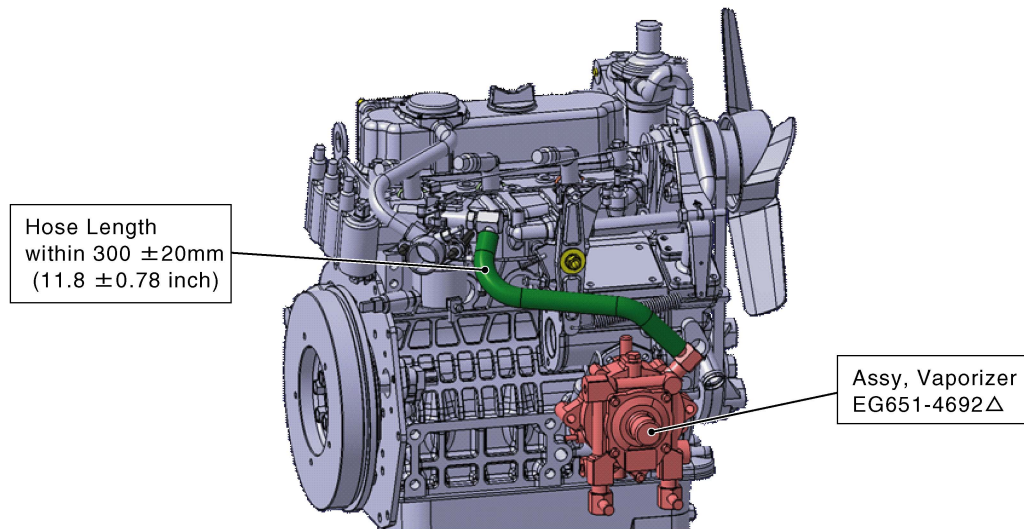


EMIO13A

[7] Vaporizer Connections

- Vaporizer Connections (WG972-GL· WG752-GL only)

The hose length between the vaporizer and carburetor must be within 300 ±20 mm (11.8 ±0.78 inch).



EMI015A

3. Production Installation Checklist

■ NOTE

- The emissions-related installation design (intake & exhaust system, gasoline fuel temperature test, etc.) is verified during the Application Review. The Application Review must be completed before the equipment is released to the market.
- Below is a checklist to be used during the final assembly of each production unit. Incorporate this checklist into your manufacturing process.

Emissions-Related Installation Check List		Page	Yes	No
1	Correct intake system confirmed at application review and/or the Exhaust Emission Check Sheet installed?	2-3		
2	Correct catalyst (Kubota parts) is installed?	4		
3	Catalyst identification information is kept with the engine information?	5		
4	Correct exhaust system installed?	6		
5	Torque of catalyst parts installation is correct?	7		
6	Correct spacer and related parts are installed? (If necessary)	8		
7	Is the other parts layout around the catalyst parts correct?	8		
8	Correct fuel system (fuel tank~purge port) confirmed at application review installed?	9-10		
9	Range of engine operation speed is correct?	10		
10	EPA and CARB emissions labels are visible?	11		
11	The hose length between vaporizer and carburetor is correct?	12		

Kubota

Emissions-Related Installation Instructions

EPA certified engines, DG972

The instructions in this document supersede any other previous instructions provided by Kubota

CONTENTS

1. Important Notice	1
2. About Objective Items.....	1
[1] Air Intake System	1
[2] Engine Set Speed.....	3
[3] Certification labels	4
[4] Regulator Connections	5
3. Production Installation Checklist.....	5

1. Important Notice

EMISSION-RELATED INSTALLATION INSTRUCTIONS

These instructions are provided for the final engine assemblers who must ensure the engine, intake system, natural gas fuel system and etc, are Installed correctly in the engine's certified configuration.

Failing to follow these instructions when installing a certified engine in a piece of non-road equipment violates federal law (40CFR 1068. 105 (b)), subject to fines or other penalties as described in the Clean Air Act.

2. About Objective Items

1. Intake System

- Kubota offers a standard Air-cleaner kit. The intake parts should be installed according to this instructions. If you use an OEM intake system for a spec engine, consult Kubota before application review. You should consult Kubota whenever you change the intake system.

2. Engine Set Speed

- You should operate the engine within the range of engine speed set at the time of Kubota shipment.

3. Engine Labels

- Kubota puts the certification label on the cylinder head cover. If you install the engine in way that makes the engine's emission control information label hard to read during normal engine maintenance, you must place a duplicate label on the equipment, as described in 40 CFR 1068.105.

4. Regulator Connections

- The hose length between the regulator and gas mixer must be within 300 ±20 mm (11.8 ±0.78 inch).

[1] Air Intake System

- Intake system means that layout of all parts from entrance of suction to air-cleaner flange.
- Kubota offers standard Air-cleaner kit. See SOS option manual about selectable Air-cleaner kit.
- The intake parts should be installed according to these instructions.
- If you use an OEM intake system for a spec engine, consult Kubota based on the Exhaust Emission Check Sheet before the application review.
- When the same specification engine is installed multiple applications, you will have to inform Kubota prior to the application review.

Also, the final intake system of each application must be confirmed at the application review and/or the Exhaust Emission Check Sheet.

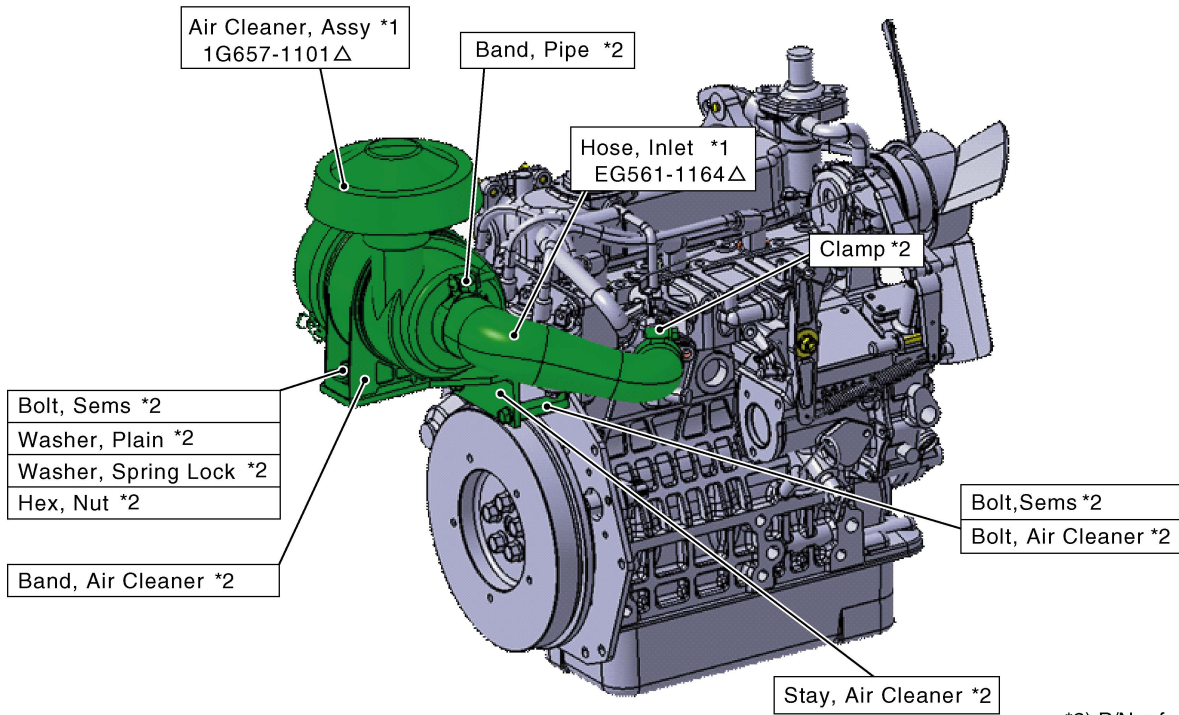
You must install the intake system confirmed at the application review and/or the Exhaust Emission Check Sheet.

[Check Item]

- You should consult Kubota based on the Exhaust Emission Check Sheet whenever you change the intake system.

Do not change without consultation with Kubota.

- External view with standard kit.
Kit parts with “*1” must be installed as shown in the figure below.



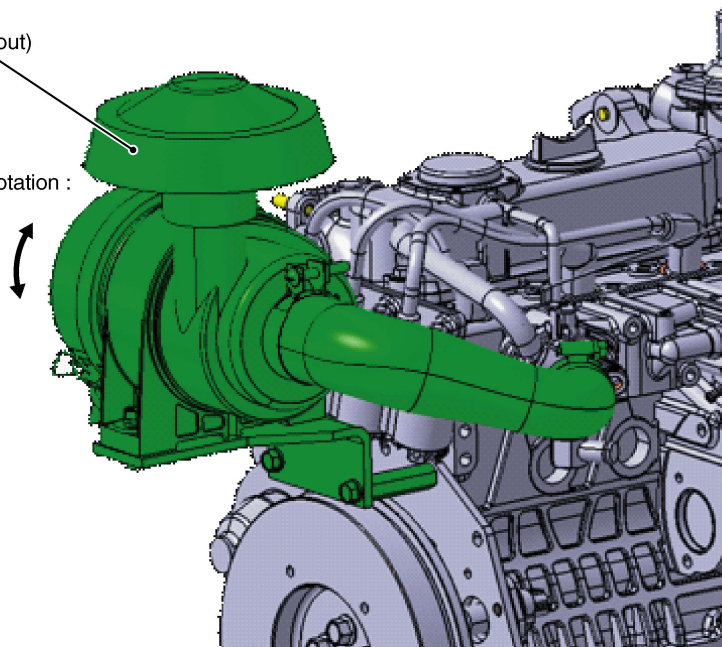
EMI017A

*2) P/N refer to SOS

- Exception
The figure below shows the range of the layout that you can select freely for the standard kit.

- Installation of Rain Cap *2
:Selectable (with or without)

Direction of Air-Cleaner rotation :
Selectable



EMI018A

*2) P/N refer to SOS

[2] Engine Set Speed

[Mechanical Governor specification]

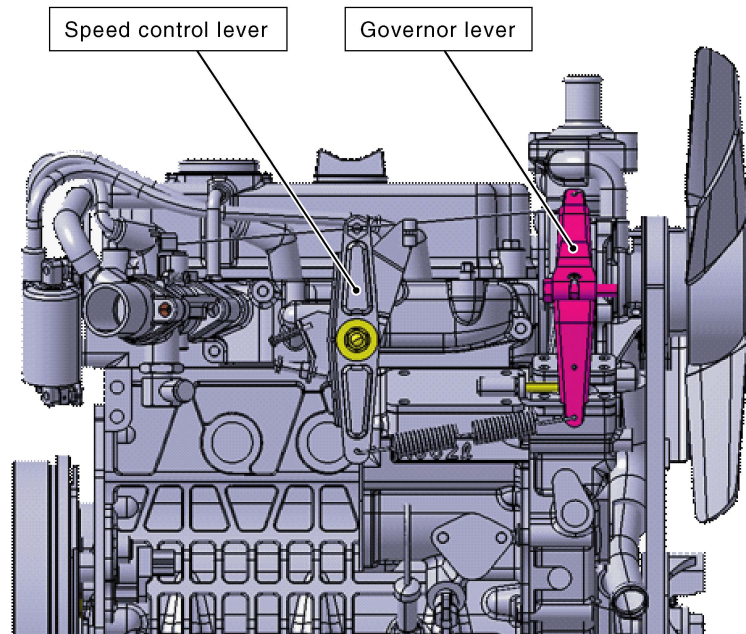
- You should operate the engine within the engine speed range set at the time of the Kubota shipment (without parasitic load).
- You should use the speed control lever and/or the governor lever to change engine speed.

Standard engine speed set of Kubota shipment (reference).

Low Idle : 1500 ± 100 rpm

High Idle : 3850^{+100}_0 rpm

Rated Speed : 3600 rpm



EMI019A

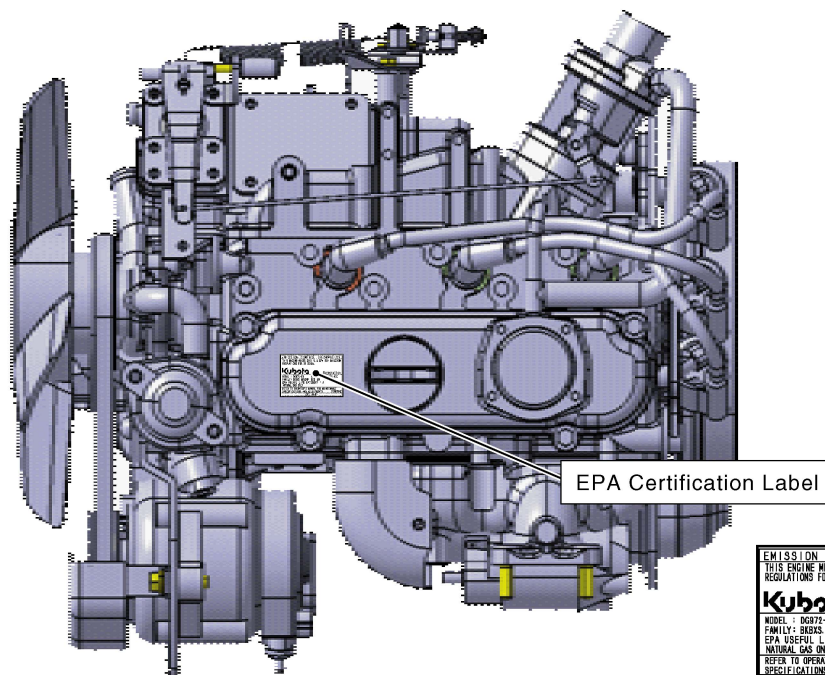
[Electronic Governor specification]

- If you use the electronic governor, consult KUBOTA before the application review.

[3] Certification labels

The following labels must be visible. If you install the engine in way that makes the engine emission control information label hard to read during normal engine maintenance, you must place a duplicate label on the equipment, as described in 40 CFR 1068.105.

- EPA certification label part numbers
1H959-8891 Δ : DG972



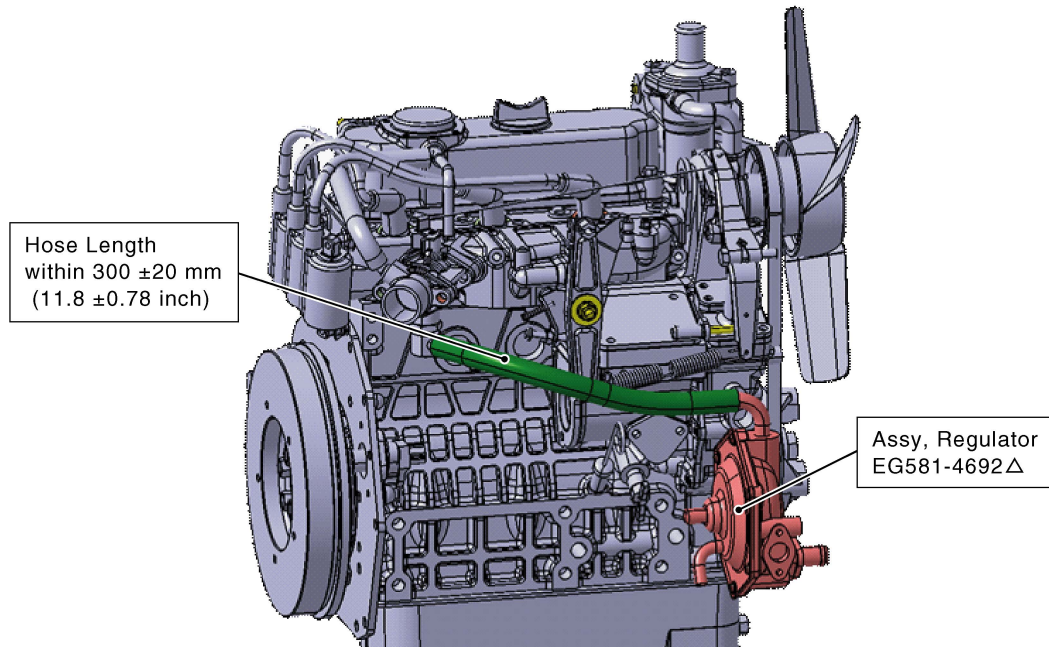
EMISSION CONTROL INFORMATION	
THIS ENGINE MEETS 2011 U.S. EPA EXH. EMISSION REGULATIONS FOR SI SORE.	
Kubota	KUBOTA Corporation
MODEL : DG972-E3	ENGINE DISP. : 992.0CC
FAMILY : DIESEL 9922HP	ECS : DA
EPA USEFUL LIFE CATEGORY : A	
NATURAL GAS ONLY	
REFER TO OPERATOR'S MANUAL FOR MAINTENANCE SPECIFICATIONS AND ADJUSTMENTS. (THREE-3)	
DEL. 8531	

EMI020A

[4] Regulator Connections

- Regulator Connections

The hose length between the regulator and gas mixer must be within 300 ± 20 mm (11.8 ± 0.78 inch).



EMI021A

3. Production Installation Checklist

■ **NOTE**

- The emissions-related installation design (intake system, natural gas fuel system, and etc.) is verified during the Application Review. The Application Review must be completed before the equipment is released to the market.
- Below is a checklist to be used during the final assembly of each production unit. Incorporate this checklist into your manufacturing process.

Emissions-Related Installation Check List		Page	Yes	No
1	Correct intake system confirmed at application review and/or the Exhaust Emission Check Sheet installed?	1-2		
2	Range of engine operation speed is correct?	3		
3	EPA emission label is visible?	4		
4	The hose length between the regulator and gas mixer is correct?	5		