

## **APPLICATION MANUAL**

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INDUSTRIAL ENGINE

***TNM, TNV***

**3TNM74F**

**3TNV74F**

**3TNV80F**

**3TNV80FT**

**3TNV88F**

***YANMAR***

**California  
Proposition 65 Warning**

Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.

**Disclaimers:**

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APPLICATION MANUAL	MODEL	3TNM74F, 3TNV74F, 3TNV80F, 3TNV80FT, 3TNV88F
	CODE	0DTNV-EN0112

# INTRODUCTION

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Prepare “TNV Series Application Manual P/N: 0DTNV-EN0033” before considering the adoption of the engine described in this manual.

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# EMISSION CONTROL REGULATIONS

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## **EPA Emission Control Regulations Manufacturer's Non-road Diesel Engine (Requirements for the Driven Machine Manufacturers)**

The TNV series are engines that have cleared the EPA regulations in North America, NRMM in Europe, and the latest exhaust gas regulations in Japan. These regulations cover non-road compression ignition engines or driven machines that are new or in-use which are produced after the effective date of the regulations.

Manufacturers of the driven machines must confirm the conditions presented by YANMAR in order for the driven machines to comply with exhaust gas regulations including EPA regulations through installation evaluation.

The following is a brief description of the responsibilities introduced by the regulation. Please contact YANMAR for further details.

### **■ Engine output**

Engine output is properly limited for not only the engines with approved emission control, but all engines at the time of shipment from YANMAR. The limit cannot be changed by the manufacturer of the driven machines or the user. Engine output is based on ISO 15550 "Gross Power Rating". "Gross Power Rating" refers to power measured with the engine equipped only with the necessary accessories for operation on the test bench.

For the engines with other load demanded by the manufacturers (such as cooling fan/fan pulley ratio and hydraulic pump load), the "net power rating" which can be obtained by subtracting the load from gross power rating is transmitted to the power line of driven machines. It is recommended to set the maximum absorption load of the driven machines to reserve 10% allowance to this net power rating. The purpose of this allowance percentage is to consider and include the difference between the actual environmental conditions of driven machines (such as ambient temperature, fuel temperature, and/or altitude) and the standard conditions for engine output settings at shipment.

### **■ Confirmation of compliance**

YANMAR and its regional headquarters will check engine performance and emissions compliance based on the guidelines in this application manual. YANMAR will confirm the results even in the case where the installation is performed by the manufacturer of the driven machines.

YANMAR will check the intake negative pressure, exhaust back pressure, and other necessary items according to the engine installation evaluation procedure.

### **■ No modification for emission-related parts**

You are not allowed to modify the emission-related parts without the permission of YANMAR. The typical emission-related parts are as follows:

EGR related parts, ECU, turbocharger, temperature sensor, pressure sensor

# EMISSION CONTROL REGULATIONS

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If you are making modification from the specification confirmed in the installation evaluation, be sure to contact YANMAR in advance to have a re-evaluation. According to the requirements of EPA Emission Standards and Related Requirements 40 CFR 1039. 130, please ensure that the engine is installed to the driven machine with certified specifications and conditions as indicated in the separate emissions control related installation instructions provided by YANMAR POWER TECHNOLOGY CO., LTD.

Please assemble according to the contents of the application manual and installation evaluation document provided by YANMAR POWER TECHNOLOGY CO., LTD.

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

## ■ Engine maintenance

Manufacturers of the driven machines are responsible for relaying all emission-related service intervals to the final user of the product.

For manufacturers of driven machines who prepare their own warranty cards, owner's manuals, service manuals, operation manuals and any related documents; they must reference the emission-related service intervals and procedures indicated in YANMAR's technical documents:

Warranty statement, operation manual, service manual and application manual.

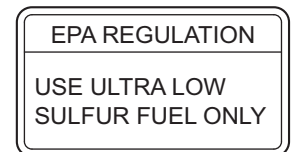
## ■ Emission control label

As an evidence of receiving the approval for the emission control regulation, attach the emission control label on the engine. If you install the engine in a way that makes the engine's EPA and NRMM label hard to read during normal engine maintenance in the machine installed condition, you must place a duplicate label on the equipment.

## ■ Fuel caution label

In accordance with the EPA emission control regulations 40CFR1039 104, it is a requirement to attach a fuel caution label near the fuel inlet of the machine.

As it can be supplied as an accessory from YANMAR, contact YANMAR as required.



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## ■ Tamper Resistance

Dealers who are authorized by YANMAR to re-adjust the diesel fuel limiter or high idle speed limit screw for market service on in-use engines, must install a tamper resistance device for preventing illegal change by the end purchaser.

## ■ Report on sales in the USA

EPA requires YANMAR to obtain and report the production quantity for sales in the United States. The driven machine manufacturer must inform YANMAR of the actual sales quantity in the United States when it differs from the quantity of YANMAR engines produced.

In such cases, a new engine model to sell exclusively in the United States can be created so that sales quantity can be recorded without informing YANMAR.

## ■ Audit by testing the market service machine (in-use regulation)

In accordance with 40 CFR 1039, audit by emission testing may be conducted, using the machine installed with the engine that is within its service life. In addition, as required by EPA regulation 40 CFR 1039. 205, we may ask for assistance such as changing to a test exhaust pipe as required by the manufacturer. YANMAR will contact you as needed. We ask you for your cooperation including borrowing of your machine.

## ■ Recall - EPA

Whenever YANMAR conducts a recall program, the schedule scheme shall be reported to the authority in advance. The remedy program shall be done accordingly. After completing the remedy work, the report shall also be reported to the authority.

## GB4 Emission Control Regulations for Non-road Diesel Engines (Requirements for the Driven Machine Manufacturers)

*Note: GB4: Chinese NRMM GB4 (Hereinafter referred to as GB4)*

This regulation applies to non-road compression-ignition engines that are used for any purpose, and enforces regulations concerning new and in-use engines that are produced on or after the implementation date and used in China.

Manufacturers of the driven machines must confirm the conditions presented by YANMAR in order for the driven machines to comply with exhaust gas regulations through installation evaluation.

The following is a brief description of the responsibilities introduced by the regulation. Please contact YANMAR for further details.

### ■ Engine output

Engine output is properly limited for not only the engines with approved emission control, but all engines at the time of shipment from YANMAR. The limit cannot be changed by the manufacturer of the driven machines or the user. Engine output is based on ISO 15550 "Gross Power Rating". "Gross Power Rating" refers to power measured with the engine equipped only with the necessary accessories for operation on the test bench.

For the engines with other load demanded by the manufacturers (such as cooling fan/fan pulley ratio and hydraulic pump load), the "net power rating" which can be obtained by subtracting the load from gross power rating is transmitted to the power line of driven machines. It is recommended to set the maximum absorption load of the driven machines to reserve 10% allowance to this net power rating. The purpose of this allowance percentage is to consider and include the difference between the actual environmental conditions of driven machines (such as ambient temperature, fuel temperature, and/or altitude) and the standard conditions for engine output settings at shipment.

### ■ Confirmation of compliance

YANMAR and its regional headquarters will check engine performance and emissions compliance based on the guidelines in this application manual. YANMAR will confirm the results even in the case where the installation is performed by the manufacturer of the driven machines.

YANMAR will check the intake negative pressure, exhaust back pressure, and other necessary items according to the engine installation evaluation procedure.

### ■ Engine maintenance

Manufacturers of the driven machines are responsible for relaying all emission-related service intervals to the final user of the product.

For manufacturers of driven machines who prepare their own warranty cards, owner's manuals, service manuals, operation manuals and any related documents; they must present the emission-related service intervals and procedures indicated in YANMAR's technical documents:

Warranty statement, operation manual, service manual and application manual.

### ■ Emission control label

According to national standard GB20891 7.2, if you install the engine in a way that makes the engine's emission control label hard to read during normal engine maintenance in the machine installed condition, you must place a duplicate label on the equipment.

### ■ Tamper Resistance

Dealers who are authorized by YANMAR to re-adjust the diesel fuel limiter or high idle speed limit screw for market service on in-use engines, must install a tamper resistance device for preventing illegal change by the end purchaser.

# EMISSION CONTROL REGULATIONS

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## ■ Obligation of in-use regulation conformity inspection

Technical Standard HJ1014 8.2.1.5, Manufacturers of driven machines are required to conduct their own inspections for in-use suitability based on their own inspection plans, and to disclose the in-use suitability in-house inspection reports for the machine.

If nonconformity is found in the in-use inspection, the schedule scheme shall be reported by YANMAR to the authority in advance. The remedy program shall be done accordingly. After completing the remedy work, the report shall also be reported to the authority.

## ■ About self-inspection

It is necessary to establish in-house inspection regulations in-house, and conduct in-house inspections to ensure that emission indicators are achieved for newly produced work machines according to the family, and disclose information on in-house inspection plans, items, sampling methods, ratios, and other in-house inspection results.

## ■ Quality assurance for exhaust gas related parts

The list of parts and materials related to emissions and their corresponding quality assurance period must be made public, and the above information must be explained in the product description.

## ■ Detailed relevant information and explanations provided to end users

Technical standard HJ1014 CC, in order to ensure that the exhaust gas performance of diesel engines always satisfies the limits, manufacturers of the driven machines must provide end users with information and necessary explanations for the correct use of diesel engines. This information includes information on fuels, lubricating oil and reactants.

Reference material: Issued by Emissions Certification and Compliance Office YANMAR POWER TECHNOLOGY CO., LTD.

## Emission-related Installation Instructions

Based on the requirements described in 40 CFR 1039.130 under the US EPA emission regulations for non-road compression ignition engines (hereinafter “Subject Engines”), YANMAR POWER TECHNOLOGY CO., LTD. (hereinafter “YANMAR”) is providing these emission-related installation instructions for the Subject Engines manufactured by YANMAR to be installed in equipment according to the specifications and installation conditions provided in YANMAR’s Application Manual and the Engine Installation Review (hereinafter, “EIR”) which the equipment manufacturer is required to follow so that the Subject Engines manufactured by YANMAR are installed in their certified configuration.

Failure to follow these instructions violates federal law (40 CFR 1068.105(b)), Subject to fines or other penalties as described in the Clean Air Act. If the EPA finds any violation caused by the equipment manufacturer, the EPA may suspend, revoke or void the engine certification and apply corresponding penalties. In such case, YANMAR will demand that the equipment manufacturer pay the penalty.

1. Properly install the intake and exhaust systems and any other components in the Subject Engines manufactured by YANMAR in accordance with the specifications provided in YANMAR’s Application Manual and the EIR including component layout. In order to meet future EPA requirements, YANMAR may request the equipment owner’s cooperation with in-use testing. In addition, YANMAR may request the equipment manufacturer to modify the original exhaust piping if necessary to satisfy the requirements described in 40 CFR 1039.205(u).
2. Operation of the Subject Engines manufactured by YANMAR for any application other than that is approved by YANMAR is prohibited. For example, do not operate the Subject Engines manufactured by YANMAR with the EPA emission control label stating that “constant speed only” in a variable speed application. YANMAR will define the range of applications in the EIR.
3. If applicable, properly install the exhaust gas after-treatment device and the related parts in the Subject Engines manufactured by YANMAR in accordance with the specifications provided in YANMAR’s Application Manual and the EIR, including component layout. Do not change or allow others to change the control system, the after-treatment device, the ECU, any other emission control devices, connections between the ECU and the emission control devices, or layout of such devices without prior written approval of YANMAR. For electronically controlled Subject Engines manufactured by YANMAR, do not install, modify or allow others to install or modify any program in the ECU other than that is provided and instructed by YANMAR so that the Subject Engines manufactured by YANMAR are electronically controlled in accordance with the specifications provided in YANMAR’s Application Manual and the EIR.
4. If you install the Subject Engines manufactured by YANMAR in a way that makes the engine’s emission control information label hard to read during normal engine maintenance, you must affix a duplicate label on the equipment as described in 40 CFR 1068.105. YANMAR will ship a duplicate label with the Subject Engines manufactured by YANMAR if requested.
5. You must affix the label “ULTRA-LOW-SULFUR FUEL ONLY”, as specified in 40 CFR 1039.104(e), on the fuel-inlet following the equipment-labeling requirements consistent with 40 CFR 1039.135. YANMAR will supply this label if requested by the equipment manufacturer, or the equipment manufacturer may prepare the label on its own.
6. Provide the YANMAR Emission Control System Warranty Statement to the ultimate purchaser of the engine in accordance with 40 CFR 1039.120. Do not modify the contents of this warranty statement because they are approved by EPA and CARB as part of the engine’s certification.
7. Give the ultimate purchaser of each new engine Maintenance instructions for properly maintaining and using the engine in accordance with 40 CFR 1039.125. Maintenance instructions are described in the operation manual as periodic maintenance. Do not modify the contents of this Maintenance instructions because they are approved by EPA as part of the engine’s certification.

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**Section 1**

# APPLICATION STANDARD

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# APPLICATION STANDARD

Refer to "ODTNV-EN0033: Section 1. Application Standard" of TNV Series Application Manual.

## Low-temperature Startability

For "Combination of Starting Devices for Each Driven Machine", refer to the below table.

### Combination of Starting Devices for Each Driven Machine

#### ■ 3TNM74F (complies with EPA Tier4/GB4)

Standard specification: For driven machine with less parasitic load when engine starts; for example, generator, mower, tractor, or combine.

Item	Temperature t (°C)	-5 < t	-15 < t ≤ -5*1	-20 ≤ t ≤ -15	-25 < t < -20	t < -20
Starter	12 V 1.0 kW, 119515-7701X DENSO	✓	✓	✓		Consult with driven machine manufacturer about specification in consideration of startability of actual machines
	12 V 1.1 kW, 119717-7701X DENSO					
	12 V 1.1 kW, 119E10-7700X Mitsubishi	✓	✓	✓		
	12 V 1.4 kW, 119740-7702X DENSO					
	12 V 1.7 kW, 129242-7701X HITACHI					
Battery	55B24 (NX100-S6) CCA: 433	✓	✓	✓		
	80D26 (NX110-5) CCA: 582					
	95D31 (NX120-7) CCA: 565					
Starting aid	Without energizing glow plug (only simultaneous energizing)					
	Glow-plug 5 sec.	✓	✓	✓		
	Glow-plug 15 sec.					
Battery cable	Total allowable resistance (YIS G30-7900J)	0.002 Ω				
Fuel oil		JIS 2nd.	JIS 3rd.	JIS 3rd. Sp.		
Lubricating oil		10W-30				

\*1: The standard specification indicated in "ODTNV-EN0033: Specifications of Standard Engines for Driven Machines (page 2-7)" of TNV Series Application Manual.

HST specification: For driven machine with parasitic load when engine starts; for example, backhoe.

Item	Temperature t (°C)	-5 < t	-15 < t ≤ -5*1	-20 ≤ t ≤ -15	-25 < t < -20	t < -20
Starter	12 V 1.0 kW, 119515-7701X DENSO					Consult with driven machine manufacturer about specification in consideration of startability of actual machines
	12 V 1.1 kW, 119717-7701X DENSO	✓	✓			
	12 V 1.1 kW, 119E10-7700X Mitsubishi	✓	✓			
	12 V 1.4 kW, 119740-7702X DENSO			✓		
	12 V 1.7 kW, 129242-7701X HITACHI					
Battery	55B24 (NX100-S6) CCA: 433	✓	✓	✓		
	80D26 (NX110-5) CCA: 582					
	95D31 (NX120-7) CCA: 565					
Starting aid	Without energizing glow plug (only simultaneous energizing)					
	Glow-plug 5 sec.	✓	✓	✓		
	Glow-plug 15 sec.					
Battery cable	Total allowable resistance (YIS G30-7900J)	0.002 Ω				
Fuel oil		JIS 2nd.	JIS 3rd.	JIS 3rd. Sp.		
Lubricating oil		10W-30				

\*1: The standard specification indicated in "ODTNV-EN0033: Specifications of Standard Engines for Driven Machines (page 2-7)" of TNV Series Application Manual.

# APPLICATION STANDARD

## ■ 3TNV74F (complies with EPA Tier4/GB4)

Standard specification: For driven machine with less parasitic load when engine starts; for example, generator, mower, tractor, or combine.

Item	Temperature t (°C)	-5 < t	-15 < t ≤ -5*1	-20 ≤ t ≤ -15	-25 < t < -20	t < -20
Starter	12 V 1.0 kW, 119515-7701X DENSO	✓	✓	✓		Consult with driven machine manufacturer about specification in consideration of startability of actual machines
	12 V 1.1 kW, 119717-7701X DENSO				✓	
	12 V 1.1 kW, 119E10-7700X Mitsubishi	✓	✓	✓	✓	
	12 V 1.4 kW, 119740-7702X DENSO					
	12 V 1.7 kW, 129242-7701X HITACHI					
Battery	55B24 (NX100-S6) CCA: 433	✓	✓	✓	✓	
	80D26 (NX110-5) CCA: 582					
	95D31 (NX120-7) CCA: 565					
Starting aid	Without energizing glow plug (only simultaneous energizing)					
	Glow-plug 5 sec.	✓	✓	✓	✓	
	Glow-plug 15 sec.					
Battery cable	Total allowable resistance (YIS G30-7900J)	0.002 Ω				
Fuel oil		JIS 2nd.	JIS 3rd.	JIS 3rd. Sp.		
Lubricating oil		10W-30			5W-20	

\*1: The standard specification indicated in "ODTNV-EN0033: Specifications of Standard Engines for Driven Machines (page 2-7)" of TNV Series Application Manual.

HST specification: For driven machine with parasitic load when engine starts; for example, backhoe.

Item	Temperature t (°C)	-5 < t	-15 < t ≤ -5*1	-20 ≤ t ≤ -15	-25 < t < -20	t < -20
Starter	12 V 1.0 kW, 119515-7701X DENSO					Consult with driven machine manufacturer about specification in consideration of startability of actual machines
	12 V 1.1 kW, 119717-7701X DENSO	✓	✓			
	12 V 1.1 kW, 119E10-7700X Mitsubishi	✓	✓			
	12 V 1.4 kW, 119740-7702X DENSO			✓	✓	
	12 V 1.7 kW, 129242-7701X HITACHI					
Battery	55B24 (NX100-S6) CCA: 433	✓	✓	✓	✓	
	80D26 (NX110-5) CCA: 582					
	95D31 (NX120-7) CCA: 565					
Starting aid	Without energizing glow plug (only simultaneous energizing)					
	Glow-plug 5 sec.	✓	✓	✓	✓	
	Glow-plug 15 sec.					
Battery cable	Total allowable resistance (YIS G30-7900J)	0.002 Ω				
Fuel oil		JIS 2nd.	JIS 3rd.	JIS 3rd. Sp.		
Lubricating oil		10W-30			5W-20	

\*1: The standard specification indicated in "ODTNV-EN0033: Specifications of Standard Engines for Driven Machines (page 2-7)" of TNV Series Application Manual.

■ 3TNV80F(T) (complies with EPA Tier4/GB4)

Standard specification: For driven machine with less parasitic load when engine starts; for example, generator, mower, tractor, or combine.

Item	Temperature t (°C)	-5 < t	-15 < t ≤ -5*1	-20 ≤ t ≤ -15	-25 < t < -20	t < -20
Starter	12 V 1.0 kW, 119515-7701X DENSO					Consult with driven machine manufacturer about specification in consideration of startability of actual machines
	12 V 1.1 kW, 119717-7701X DENSO	✓	✓	✓	✓	
	12 V 1.1 kW, 119E10-7700X Mitsubishi	✓	✓	✓	✓	
	12 V 1.4 kW, 119740-7702X DENSO					
	12 V 1.7 kW, 129242-7701X HITACHI					
Battery	55B24 (NX100-S6) CCA: 433	✓	✓	✓	✓	
	80D26 (NX110-5) CCA: 582					
	95D31 (NX120-7) CCA: 565					
Starting aid	Without energizing glow plug (only simultaneous energizing)					
	Glow-plug 5 sec.	✓	✓	✓	✓	
	Glow-plug 15 sec.					
Battery cable	Total allowable resistance (YIS G30-7900J)	0.002 Ω				
Fuel oil		JIS 2nd.	JIS 3rd.	JIS 3rd. Sp.		
Lubricating oil		10W-30			5W-20	

\*1: The standard specification indicated in "ODTNV-EN0033: Specifications of Standard Engines for Driven Machines (page 2-7)" of TNV Series Application Manual.

HST specification: For driven machine with parasitic load when engine starts; for example, backhoe.

Item	Temperature t (°C)	-5 < t	-15 < t ≤ -5*1	-20 ≤ t ≤ -15	-25 < t < -20	t < -20
Starter	12 V 1.0 kW, 119515-7701X DENSO					Consult with driven machine manufacturer about specification in consideration of startability of actual machines
	12 V 1.1 kW, 119717-7701X DENSO	✓				
	12 V 1.1 kW, 119E10-7700X Mitsubishi	✓				
	12 V 1.4 kW, 119740-7702X DENSO		✓	✓	✓	
	12 V 1.7 kW, 129242-7701X HITACHI					
Battery	55B24 (NX100-S6) CCA: 433	✓	✓			
	80D26 (NX110-5) CCA: 582			✓	✓	
	95D31 (NX120-7) CCA: 565					
Starting aid	Without energizing glow plug (only simultaneous energizing)					
	Glow-plug 5 sec.	✓	✓	✓	✓	
	Glow-plug 15 sec.					
Battery cable	Total allowable resistance (YIS G30-7900J)	0.002 Ω				
Fuel oil		JIS 2nd.	JIS 3rd.	JIS 3rd. Sp.		
Lubricating oil		10W-30			5W-20	

\*1: The standard specification indicated in "ODTNV-EN0033: Specifications of Standard Engines for Driven Machines (page 2-7)" of TNV Series Application Manual.

# APPLICATION STANDARD

## ■ 3TNV88F (complies with EPA Tier4)

Standard specification: For driven machine with less parasitic load when engine starts; for example, generator, mower, tractor, or combine.

Item	Temperature t (°C)	-5 < t	-15 < t ≤ -5*1	-20 ≤ t ≤ -15	-25 < t < -20	t < -20
Starter	12 V 1.0 kW, 119515-7701X DENSO					Consult with driven machine manufacturer about specification in consideration of startability of actual machines
	12 V 1.1 kW, 119717-7701X DENSO					
	12 V 1.1 kW, 119E10-7700X Mitsubishi					
	12 V 1.4 kW, 119740-7702X DENSO					
	12 V 1.7 kW, 129242-7701X HITACHI	✓	✓	✓		
Battery	55B24 (NX100-S6) CCA: 433					
	80D26 (NX110-5) CCA: 582	✓	✓	✓		
	95D31 (NX120-7) CCA: 565					
Starting aid	Without energizing glow plug (only simultaneous energizing)					
	Glow-plug 5 sec.					
	Glow-plug 15 sec.		✓	✓		
Battery cable	Total allowable resistance (YIS G30-7900J)	0.002 Ω				
Fuel oil		JIS 2nd.	JIS 3rd.	JIS 3rd. Sp.		
Lubricating oil		10W-30				

\*1: The standard specification indicated in "ODTNV-EN0033: Specifications of Standard Engines for Driven Machines (page 2-7)" of TNV Series Application Manual.

HST specification: For driven machine with parasitic load when engine starts; for example, backhoe.

Item	Temperature t (°C)	-5 < t	-15 < t ≤ -5*1	-20 ≤ t ≤ -15	-25 < t < -20	t < -20
Starter	12 V 1.0 kW, 119515-7701X DENSO					Consult with driven machine manufacturer about specification in consideration of startability of actual machines
	12 V 1.1 kW, 119717-7701X DENSO					
	12 V 1.1 kW, 119E10-7700X Mitsubishi					
	12 V 1.4 kW, 119740-7702X DENSO					
	12 V 1.7 kW, 129242-7701X HITACHI	✓	✓	✓		
Battery	55B24 (NX100-S6) CCA: 433					
	80D26 (NX110-5) CCA: 582	✓	✓			
	95D31 (NX120-7) CCA: 565			✓		
Starting aid	Without energizing glow plug (only simultaneous energizing)					
	Glow-plug 5 sec.					
	Glow-plug 15 sec.		✓	✓		
Battery cable	Total allowable resistance (YIS G30-7900J)	0.002 Ω				
Fuel oil		JIS 2nd.	JIS 3rd.	JIS 3rd. Sp.		
Lubricating oil		10W-30				

\*1: The standard specification indicated in "ODTNV-EN0033: Specifications of Standard Engines for Driven Machines (page 2-7)" of TNV Series Application Manual.

## Allowable Air Intake Restriction and Exhaust Back Pressures

For “Allowable air intake restriction”, refer to the below table.

### ■ Allowable air intake restriction (complies with EPA F-Tier4)

25 °C, relative humidity: 30%

Applicable model	Atmosphere pressure (altitude)	Allowable depression at engine manifold ≤ kPa (mmAq)	
		Initial upper limit	Air cleaner usage upper limit
3TNM74F, 3TNV74F, 3TNV80F, 3TNV80FT, 3TNV88F	101.3 kPa (0 m or equivalent, reference value)	2.94	6.23 (0 - 800 m, 0 - 2624 ft.)
	92.1 kPa (800 m or equivalent, reference value)	2.67	
	82.8 kPa (1676 m or equivalent, reference value)	2.40	4.00 (800 - 1676 m, 2624 - 5500 ft.)

For “Allowable exhaust back pressure”, refer to the below table.

### ■ Allowable exhaust back pressure

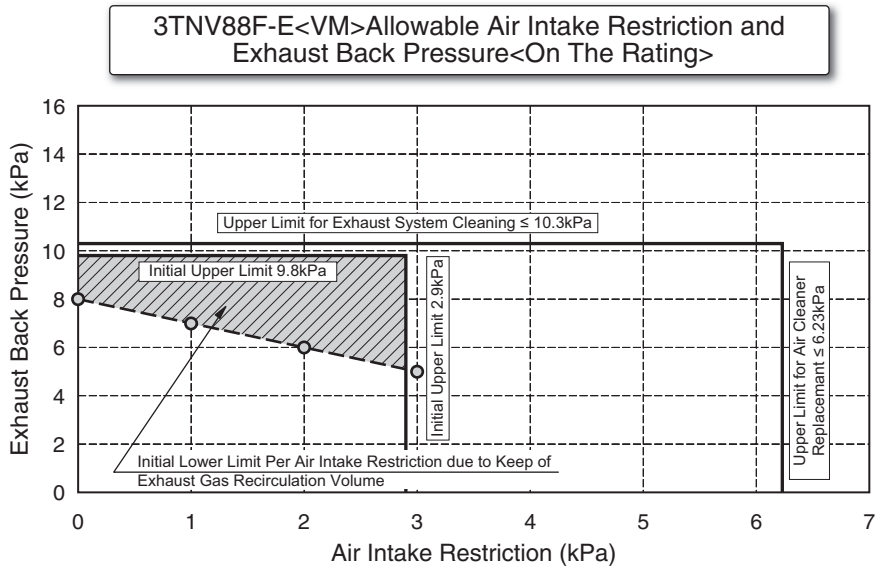
25 °C, relative humidity: 30%

Applicable model	Atmosphere pressure (altitude)	Allowable exhaust back pressure ≤ kPa (mmAq)	
		Initial upper limit	Exhaust system usage upper limit
3TNM74F, 3TNV74F, 3TNV80F, 3TNV80FT, 3TNV88F	101.3 kPa (0 m or equivalent, reference value)	9.81	10.30 (0 - 800 m, 0 - 2624 ft.)
	92.1 kPa (800 m or equivalent, reference value)	8.98	
	82.8 kPa (1676 m or equivalent, reference value)	8.02	8.10 (800 - 1676 m, 2624 - 5500 ft.)

# APPLICATION STANDARD

For “3TNV88F-E<VM>: Allowable intake/exhaust pressure settings (at rated output)”, refer to the below table.

## ■ 3TNV88F-E<VM>: Allowable intake/exhaust pressure settings (at rated output)



Lower Limit of Exhaust Back Pressure set by Air Intake Restriction

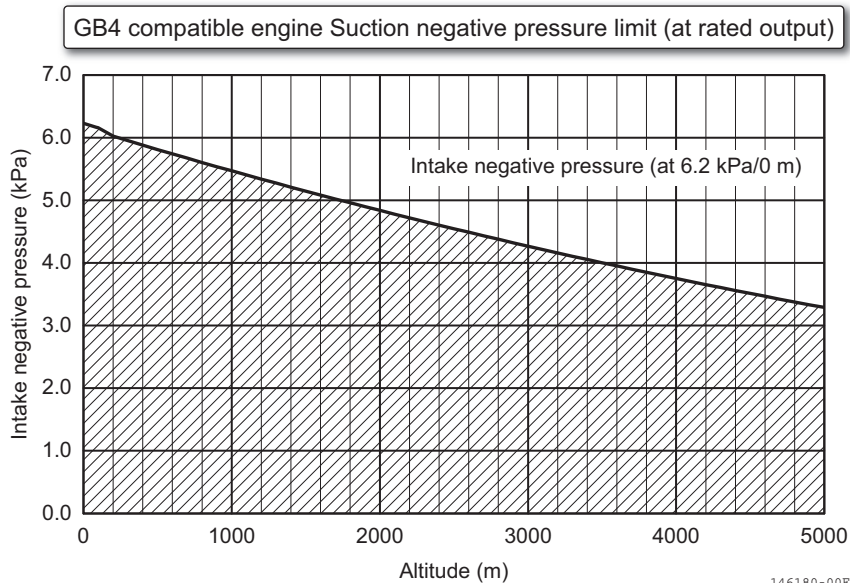
Air Intake Restriction (kPa)	0	1	2	3
Exhaust Back Pressure (kPa)	8	7	6	5

049306-00EN00

Please refer to the diagram below for “GB4 compatible engine allowable intake pressure setting (at 100% output)”.

## ■ Allowable intake negative pressure setting (complies with GB4)

Chinese regulations include smoke regulations for driven machines, and the generation of smoke depends greatly on the amount of intake air. To comply with smoke regulations, keep the intake negative pressure within the value shown in the diagram below.



146180-00EN

## Section 2

# ENGINE MODEL SELECTION

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# ENGINE MODEL SELECTION

Refer to “ODTNV-EN0033: Section 2. Engine Model Selection” of TNV Series Application Manual.

## Engine Classification

For “Engine classification with above mentioned conditions”, refer to the below table.

### ■ Engine classification with above mentioned conditions

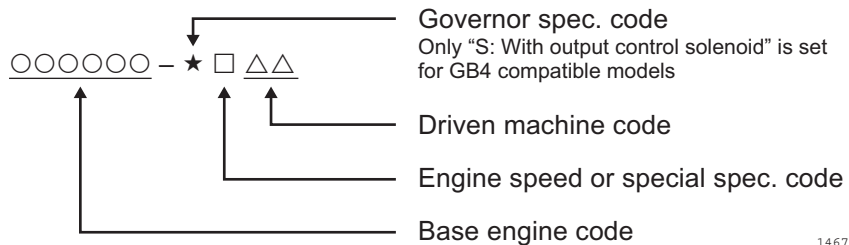
No.	Model (including the governor spec. code)	Combustion chamber type	Group	Classification			
				CL	VM	CH	VH
1	3TNM74F-S	IDI	MINIMAX	-	-	○	-
	3TNM74F-N			○	-	-	-
2	3TNV74F-S		NV1	-	○	-	-
3	3TNV80F-S			-	○	-	-
	3TNV80F-N		○	-	-	-	
4	3TNV80FT-Z		-	○	-	-	
5	3TNV88F-E	DI	NV2	-	○	-	-
	3TNV88F-U			○	-	-	-

## Standard Engines for Driven Machines

For “Engine model nomenclature”, refer to the following:

### ■ Engine model nomenclature

IDI engine model corresponding to EPA F-Tier4/GB4



146760-00EN

Governor spec. code	Governor specification	Engine output specification
Z	Electronic governor (eco governor)	Standard output specification
B	Mechanical governor	
E	Electronic governor (eco governor)	Derating output specification
U	Mechanical governor	
N	With the output control solenoid	
S	With the output control solenoid	

## Section 3

# SPECIFICATIONS

---

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# SPECIFICATIONS

Refer to "ODTNV-EN0033: Section 3. Specifications" of TNV Series Application Manual.

## Specifications

For "Specifications", refer to the next table.

### ■ 3TNM74F (complies with EPA F-Tier4)

Engine model			3TNM74F-N		3TNM74F-S			
Engine classification			CL	CH	VH			
1	Type	–	Vertical, 4-cycle water-cooled diesel engine					
2	Combustion system	–	Spherical swirl chamber system (IDI)					
3	No. of cylinders - Bore x stroke	n - mm x mm	3 - 74 x 77					
4	Displacement	L	0.993					
5	Rated engine speed	min <sup>-1</sup>	1800	3600	3200	3400	3600	
	Output (gross)	Cont. rating	kW	7.9	15.9	–	–	–
		Rated output	kW	8.8	17.8	16.0	17.0	17.8
6	Maximum idling speed	min <sup>-1</sup>	1925	3770	3415	3630	3840	
7	Compression ratio	–	23.5					
8	Main shaft side	–	Flywheel side					
9	Rotation direction	–	Counterclockwise (viewed from flywheel side)					
10	Governor	–	Mechanical centrifugal governor (All-speed governor)					
11	Aspiration	–	Natural aspiration					
12	Cooling system	–	Force-feed circulation radiator type cooling system					
13	Lubricating system	–	Forced lubrication with trochoid pump					
14	Starting system	–	Electric starting					
15	Charging system	–	Alternator					
16	Starting aid device	–	Glow plug					

■ **3TNM74F-S (complies with GB4)**

Engine model			3TNM74F-S			
Engine classification			VH			
1	Type	–	Vertical, 4-cycle water-cooled diesel engine			
2	Combustion system	–	Spherical swirl chamber system (IDI)			
3	No. of cylinders - Bore × stroke	n - mm × mm	3 - 74 × 77			
4	Displacement	L	0.993			
5	Rated engine speed		min <sup>-1</sup>	3200	3400	3600
	Output (gross)	Cont. rating	kW	–	–	–
		Rated output	kW	16.0	17.0	17.8
6	Maximum idling speed	min <sup>-1</sup>	3415	3630	3840	
7	Compression ratio	–	23.5			
8	Main shaft side	–	Flywheel side			
9	Rotation direction	–	Counterclockwise (viewed from flywheel side)			
10	Governor	–	Mechanical centrifugal governor (All-speed governor)			
11	Aspiration	–	Natural aspiration			
12	Cooling system	–	Force-feed circulation radiator type cooling system			
13	Lubricating system	–	Forced lubrication with trochoid pump			
14	Starting system	–	Electric starting			
15	Charging system	–	Alternator			
16	Starting aid device	–	Glow plug			

# SPECIFICATIONS

## ■ 3TNV74F-S (complies with EPA F-Tier4/GB4)

Engine model			3TNV74F-S		
Engine classification			VM		
1	Type	–	Vertical, 4-cycle water-cooled diesel engine		
2	Combustion system	–	Spherical swirl chamber system (IDI)		
3	No. of cylinders - Bore × stroke	n - mm × mm	3 - 74 × 77		
4	Displacement	L	0.993		
5	Rated engine speed	min <sup>-1</sup>	2400	2500	3000
	Output (gross)	Cont. rating	kW	–	–
		Rated output	kW	11.2	11.6
6	Maximum idling speed	min <sup>-1</sup>	2595	2700	3235
7	Compression ratio	–	23.1		
8	Main shaft side	–	Flywheel side		
9	Rotation direction	–	Counterclockwise (viewed from flywheel side)		
10	Governor	–	Mechanical centrifugal governor (All-speed governor)		
11	Aspiration	–	Natural aspiration		
12	Cooling system	–	Force-feed circulation radiator type cooling system		
13	Lubricating system	–	Forced lubrication with trochoid pump		
14	Starting system	–	Electric starting		
15	Charging system	–	Alternator		
16	Starting aid device	–	Glow plug		

## ■ 3TNV80F (complies with EPA F-Tier4)

Engine model			3TNV80F-N	3TNV80F-S						
Engine classification			CL	VM						
1	Type	–	Vertical, 4-cycle water-cooled diesel engine							
2	Combustion system	–	Spherical swirl chamber system (IDI)							
3	No. of cylinders - Bore × stroke	n - mm × mm	3 - 80 × 84							
4	Displacement	L	1.266							
5	Rated engine speed		min <sup>-1</sup>	1800	2200	2400	2500	2600	2800	3000
	Output (gross)	Cont. rating	kW	9.7	–	–	–	–	–	–
		Rated output	kW	10.7	13.4	14.6	15.2	15.8	17.0	17.8
6	Maximum idling speed	min <sup>-1</sup>	1900	2380	2595	2700	2815	3020	3235	
7	Compression ratio	–	23.1							
8	Main shaft side	–	Flywheel side							
9	Rotation direction	–	Counterclockwise (viewed from flywheel side)							
10	Governor	–	Mechanical centrifugal governor (All-speed governor)							
11	Aspiration	–	Natural aspiration							
12	Cooling system	–	Force-feed circulation radiator type cooling system							
13	Lubricating system	–	Forced lubrication with trochoid pump							
14	Starting system	–	Electric starting							
15	Charging system	–	Alternator							
16	Starting aid device	–	Glow plug							

# SPECIFICATIONS

## ■ 3TNV80F-S (complies with GB4)

Engine model			3TNV80F-S						
Engine classification			VM					VH	
1	Type	–	Vertical, 4-cycle water-cooled diesel engine						
2	Combustion system	–	Spherical swirl chamber system (IDI)						
3	No. of cylinders - Bore x stroke	n - mm x mm	3 - 80 x 84						
4	Displacement	L	1.266						
5	Rated engine speed		min <sup>-1</sup>	2200	2400	2500	2800	3000	3200
	Output (gross)	Cont. rating	kW	–	–	–	–	–	–
		Rated output	kW	13.4	14.6	15.2	17.0	17.8	17.8
6	Maximum idling speed	min <sup>-1</sup>	2380	2595	2700	3020	3235	3415	
7	Compression ratio	–	23.1						
8	Main shaft side	–	Flywheel side						
9	Rotation direction	–	Counterclockwise (viewed from flywheel side)						
10	Governor	–	Mechanical centrifugal governor (All-speed governor)						
11	Aspiration	–	Natural aspiration						
12	Cooling system	–	Force-feed circulation radiator type cooling system						
13	Lubricating system	–	Forced lubrication with trochoid pump						
14	Starting system	–	Electric starting						
15	Charging system	–	Alternator						
16	Starting aid device	–	Glow plug						

**■ 3TNV80FT (complies with EPA F-Tier4)**

Engine model			3TNV80FT-Z
Engine classification			VM
1	Type	–	Vertical, 4-cycle water-cooled diesel engine
2	Combustion system	–	Spherical swirl chamber system (IDI)
3	No. of cylinders - Bore × stroke	n - mm × mm	3 - 80 × 84
4	Displacement	L	1.266
5	Rated engine speed		min <sup>-1</sup> 2600
	Output (gross)	Cont. rating	kW –
		Rated output	kW 18.4
6	Maximum idling speed	min <sup>-1</sup>	2750
7	Compression ratio	–	22.5
8	Main shaft side	–	Flywheel side
9	Rotation direction	–	Counterclockwise (viewed from flywheel side)
10	Governor	–	Electronic governor (All-speed governor)
11	Aspiration	–	Turbocharging
12	Cooling system	–	Force-feed circulation radiator type cooling system
13	Lubricating system	–	Forced lubrication with trochoid pump
14	Starting system	–	Electric starting
15	Charging system	–	Alternator
16	Starting aid device	–	Glow plug

# SPECIFICATIONS

## ■ 3TNV88F (complies with EPA F-Tier4)

Engine model			3TNV88F-U	3TNV88F-E			
Engine classification			CL	VM			
1	Type	–	Vertical, 4-cycle water-cooled diesel engine				
2	Combustion system	–	Direct injection				
3	No. of cylinders - Bore x stroke	n - mm x mm	3 - 88 x 90				
4	Displacement	L	1.642				
5	Rated engine speed	min <sup>-1</sup>	1800	2200	2300	2400	
	Output (gross)	Cont. rating	kW	14.3	–	–	–
		Rated output	kW	15.7	18.2	18.2	18.2
6	Maximum idling speed	min <sup>-1</sup>	1915	2350	2450	2550	
7	Compression ratio	–	19.1				
8	Main shaft side	–	Flywheel side				
9	Rotation direction	–	Counterclockwise (viewed from flywheel side)				
10	Governor	–	Mechanical centrifugal governor (All-speed governor)	Electronic governor (All-speed governor)			
11	Aspiration	–	Natural aspiration				
12	Cooling system	–	Force-feed circulation radiator type cooling system				
13	Lubricating system	–	Forced lubrication with trochoid pump				
14	Starting system	–	Electric starting				
15	Charging system	–	Alternator				
16	Starting aid device	–	Glow plug				

## Section 4

# CORRECTING OBSERVED POWER

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## CORRECTING OBSERVED POWER

Refer to “ODTNV-EN0033: Section 4. Correcting Observed Power” of TNV Series Application Manual.

### Power Corrections

For “Engine factor:  $f_m$  at rated output of TNV engines”, refer to the below table.

#### ■ Engine factor: $f_m$ at rated output of TNV engines (complies with EPA F-Tier4)

Model	Rated speed (min <sup>-1</sup> )												
	For industrial use									For generators			
	2000	2200	2400	2600	2800	3000	3200	3400	3600	1500	1800	3000	3600
3TNM74F	–	–	–	–	–	–	0.563	0.623	0.658	0.457	0.461	0.491	0.658
3TNV74F	0.317	0.346	0.360	–	–	0.454	–	–	–	–	–	–	–
3TNV80F	–	0.372	0.376	0.391	0.390	0.383	0.309	–	–	0.280	0.290	–	–
3TNV80FT	–	–	–	0.200	–	–	–	–	–	–	–	–	–
3TNV88F	–	0.407	0.432	–	–	–	–	–	–	0.256	0.296	–	–

#### ■ Engine factor: $f_m$ at rated output of TNV engines (complies with GB4)

Model	Rated speed (min <sup>-1</sup> )										
	For industrial use										
	2000	2200	2400	2500	2600	2800	3000	3200	3400	3600	
3TNM74F-S	–	–	–	–	–	–	–	0.563	0.623	0.658	
3TNV74F-S	–	–	0.360	Under confirmation	–	–	0.454	–	–	–	
3TNV80F-S	–	0.372	–	Under confirmation	–	0.390	0.383	0.309	–	–	

For “Corrections for High Altitudes”, refer to the following:

## Corrections for High Altitudes

As described in *Power Corrections on page 4-2*, the output decreases at higher altitudes, and the exhaust gas density increases. Under the Tier4/GB4 standard, exhaust gas emissions must be guaranteed up to a high altitudes of 5,500 ft (1676.4 m).

To guarantee engine performance and durability at high altitudes, high altitude correction control is applied.

### Output Correction

Reduction of output with regard to increase and decrease of altitude is summarized below, on the basis of actual measurement.

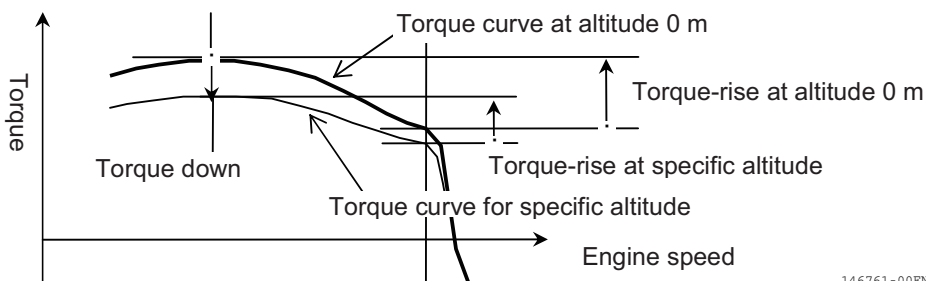
Altitude (m)		0	1000	2000	3000
Reduction of rated output (%)	Naturally aspirated engines	0	10	20	30
	Turbocharged engines	0	7	10	15

### Torque Correction

The operating altitude of an engine affects the maximum torque because the excess air ratio is too low to allow the engine to attain the rated output. The reduction of maximum torque is described below.

Regarding details on engine performance at high altitudes, please contact YANMAR.

Altitude (m)		0	1000	2000	3000
Reduction of maximum torque (%)	Naturally aspirated engines	0	20	30	35
	Turbocharged engines	0	10	15	20



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### Exhaust White Smoke

White smoke generation immediately after starting the engine increases and lasts longer at higher altitudes due to ignition delay caused by the decreased air density and temperature.

The following measures are available for these problems.

- Use of diesel fuel with higher cetane number: 52 or greater
- Energization of glow plug after starting

# CORRECTING OBSERVED POWER

## Misfire at High Altitude

If the engine is operated at high speed immediately after starting at high altitudes, a misfire is likely to occur due to ignition delay caused by the decreased air density and outdoor temperature.

Actions similar to those against white smoke generation in *Exhaust White Smoke on page 4-3* are required in order to reduce misfire. Sufficient warming up of the engine (at least 5 minutes) at medium or lower speed is also required.

## Others

In addition to the above, the following problem can occur.

### ■ Increased heat load due to rise of exhaust temperature

Altitude (m)		0	1000	2000	3000
Rise of exhaust temperature at rated output (%)	Naturally aspirated engines	0.0	2.0	3.0	3.0
	Turbocharged engines	0.0	0.0	1.0	4.0

## Output Control Device (3TNV74/80F(T), 3TNM74F)

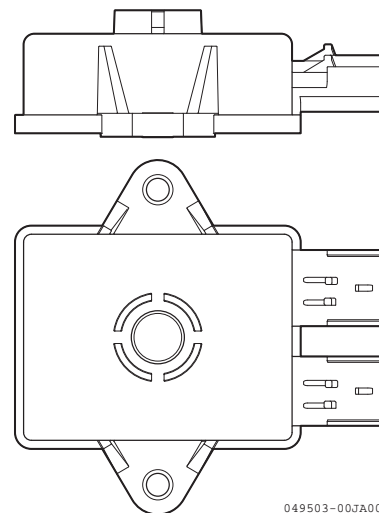
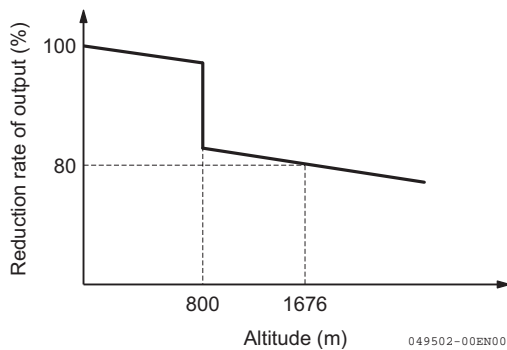
To control the PM increase at high altitude, detect the atmosphere pressure and control the output to comply with the emission control regulations.

By turning on and off the output control solenoid, limit the injection volume at high altitude and perform the output control.

The output control detects altitude (atmosphere pressure) for judgment when the engine is started. If the atmosphere pressure of altitude 800 m or higher is detected, the output control is performed.

The atmosphere pressure sensor built into the solenoid driver detects the atmosphere pressure.

The altitude judgment is only performed when the engine is started. If the change of altitude is accompanied at the vicinity of the operating altitude, stop and restart the engine.



Solenoid driver

## Detection of Atmosphere Pressure and Operation of Solenoid

The solenoid is energized when the engine is started and turned into the low altitude mode. The high altitude control necessity is judged while the engine is started. If judged as the high altitude, the energization is released at the end of the engine start (the elapse of 4 seconds after turning off the key switch) and it is turned into the high altitude mode.

### Specification of solenoid driver

Supply voltage	At operation	12 V DC (10 - 16 V)
Ambient temperature	At operation	-30 to 100 °C
	At storage	-40 to 110 °C
Vibration		< 90 m/s <sup>2</sup> (10 - 500 Hz)
Waterproofness		IPX6, Body: JIS D0203 S2 (Connector: JIS D0203 S2)
Atmosphere pressure at starting the high altitude injection volume control		92.1 kPa (@25 °C) (Altitude: Approx. 2624 ft (800 m))

## Precautions for installation

### ***Installation position***

- Install it at a high position as much as possible to avoid water pouring to the solenoid driver due to the vehicle submerge.
- Although the solenoid driver is of waterproof structure, there is no functional guarantee for water submerge.
- Do not install it at a position where water is always splashed.
- Avoid installing it at a position where the high pressure car wash is splashed directly as much as possible.

### ***Installation direction***

The directions shown in the following figure is considered as the basic. The rotation/inclination range shown in the figure is recommended.

#### **Reasons:**

- To prevent the water droplet coming along the wire from accumulating in the connector and the vent opening.

### ***Conditions of installation portion***

- Install the solenoid driver to a portion with the good thermal conductivity and the heat radiation by air circulation.
- You cannot install it directly to the engine.

### ***Protection against dirt***

- Install the dirt cover to a position where dirt may always splash.
- Do not install it at a position where lubricating oil and engine oil may splash. (If the vent opening is closed, the solenoid cannot operate properly.)

### ***Masking***

- The installation surface can be painted. (The solenoid driver is not structured to directly have the grounding to the body of a vehicle.)
- Do not paint the atmosphere pressure sensor vent opening.

# CORRECTING OBSERVED POWER

## ***Harness pull out direction***

- Remove the wire harness facing down for the installation direction of the solenoid driver in the following figure.

## ***Harness clamp***

- Clamp the wire harness connected to the solenoid driver with an appropriate looseness near the driver (approx. 20 to 30 cm). (Including the solenoid.)
- Lead the wire to avoid the water droplet coming along the wire from accumulating in the connector.

## ***Requirement specification from the connector manufacturer***

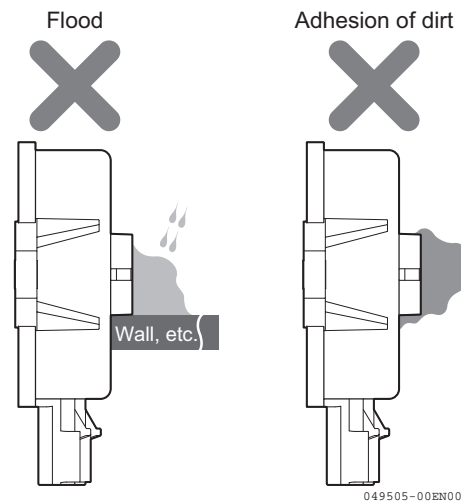
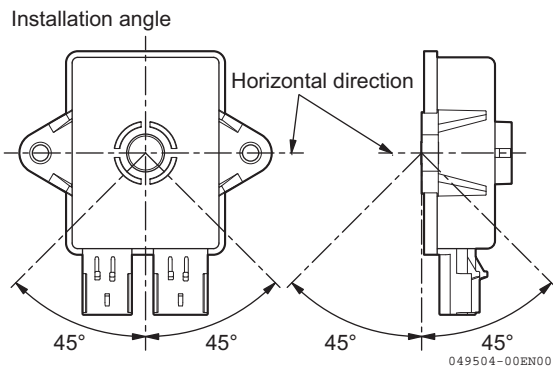
Comply with the connector manufacturer specification in regard to design of the wire harness and handling of the connector. The wire coating diameter has an influence on the waterproof functionality in particular.

## ***Waterproofness of the solenoid driver unit***

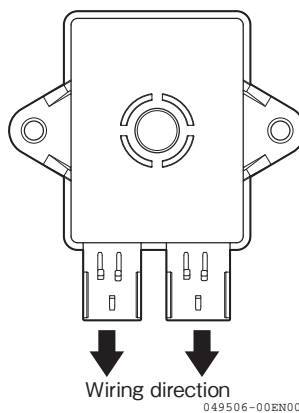
There is no waterproof guarantee for the solenoid driver unit.

## ***Handling***

- Do not use the fallen solenoid driver.
- Do not touch the terminal with your hand or disassemble it.
- The solenoid driver has an internal circuit that generates the high voltage. Be careful of electric shock.



Blockage of the vent opening for atmosphere pressure sensor



## Section 5

# ENGINE PERFORMANCE

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## ENGINE PERFORMANCE

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Refer to “*ODTNV-EN0033: Section 5. Engine Performance*” of TNV Series Application Manual.

## Section 6

# COLD STARTING AIDS

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## COLD STARTING AIDS

Refer to “ODTNV-EN0033: Section 6. Cold Starting Aids” of TNV Series Application Manual.

For “Control circuit”, refer to the below table.

Applicable model	IDI		DI	
	3TNM74F 3TNV74F/80F	3TNV80FT-Z	3TNV88F-U	3TNV88F-E
Starting aid Control circuit	Glow plug			
Mechanical governor Standard (preheat) control	Control circuit diagram for standard glow plug: Refer to “ODTNV-EN0033: <b>Figure 6-2</b> ” of TNV Series Application Manual.	–	Control circuit diagram for standard glow plug: Refer to “ODTNV-EN0033: <b>Figure 6-2</b> ” of TNV Series Application Manual.	–
Mechanical governor On-glow control	Control circuit diagram for standard glow plug: Refer to “ODTNV-EN0033: <b>Figure 6-4</b> ” of TNV Series Application Manual.	–	Control circuit diagram for standard glow plug: Refer to “ODTNV-EN0033: <b>Figure 6-4</b> ” of TNV Series Application Manual.	–
Eco governor Preheat control/ On-glow control	–	Control circuit diagram for on-glow: Refer to “ODTNV-EN0033: <b>Figure 14-38</b> ” of TNV Series Application Manual.	–	Control circuit diagram for on-glow: Refer to “ODTNV-EN0033: <b>Figure 14-38</b> ” of TNV Series Application Manual.

## Glow Plug

For “Glow Plug Specification”, refer to the below table.

Applicable model	IDI (3TNM74F, 3TNV74F/80F(T))	DI (3TNV88F)
Nominal voltage (V)	12	12
Type name	Standard glow plug	Standard glow plug
Part code	119717-7780X (119717-7781X)	129008-7781X
Standard preheating time (sec.)	5	15
Rated capacity (V/A)	11/ 9.0 ± 1.0	11/ 9.0 ± 1.0
Identification color	Red	Red

**Section 7**

# AIR INTAKE SYSTEM

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## AIR INTAKE SYSTEM

Refer to “ODTNV-EN0033: Section 7. Air Intake System” of TNV Series Application Manual.

### Air Capacity Required for Combustion

For “Air Capacity Required for Combustion (m<sup>3</sup>/min)”, refer to the below table.

N: Engine speed (min<sup>-1</sup>)

No.	Engine model	Engine displacement: (L)	Required air capacity $Q_I$ for combustion: (m <sup>3</sup> /min)
1	3TNM74F	0.993	$4.47 \times 10^{-4} \times N$
2	3TNV74F	0.993	$4.47 \times 10^{-4} \times N$
3	3TNV80F	1.266	$5.70 \times 10^{-4} \times N$
4	3TNV80FT	1.266	$1.01 \times 10^{-3} \times N$
5	3TNV88F	1.642	$7.39 \times 10^{-3} \times N$

For “Air Cleaner Selection Table”, refer to the below table.

### Air Cleaner Selection Table

Single element	CL		VM								VH/CH			
	min <sup>-1</sup>	1500	1800	2000	2200	2400	2500	2600	2800	3000	3200	3400	3600	
3TNM74F		4 inch					–	4 inch				5 inch		
3TNV74F		4 inch											5 inch	
3TNV80F		4 inch						5 inch			–			
3TNV80FT		–						5 inch		–				
3TNV88F		5 inch					–							

Double element	CL		VM								VH/CH				
	min <sup>-1</sup>	1500	1800	2000	2200	2400	2500	2600	2800	3000	3200	3400	3600		
3TNM74F		4 inch					–	5 inch							
3TNV74F		4 inch						5 inch							
3TNV80F		4 inch			5 inch								–		
3TNV80FT		–						5 inch		–					
3TNV88F		5 inch					–								

## Air Cleaner

For “Dust Indicator”, refer to the following:

### Dust Indicator

#### ■ Mechanical dust indicator

A dust indicator is mounted on the air outlet of the air cleaner to indicate the degree of air restriction and is available in a mechanical or electric type. Both types actuate when the intake air flow restriction reaches 6.23 kPa (635 mmAq). When the mechanical type of dust indicator actuates, a “red band” appears inside of the indicator’s body. The mechanical indicator has a latching feature and reset button. When the electric type of dust indicator actuates, an indicator lamp or LED comes on.



**Figure 7-1**

	<b>Atmosphere pressure</b>	<b>Upper limit pressure for air cleaner cleaning</b>	<b>Indicator indication value/altitude</b>
0 m (0 ft)	(101.3)	(6.2)	6.2/0 m
0 - 800 m (0 - 2624 ft)	(92.1)	(6.2)	5.6/800 m
800 - 1676 m (2624 - 5500 ft)	(82.8)	(4.0)	3.2/1676 m

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**Section 8**

# EXHAUST SYSTEM

---

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Exhaust Gas Volume and Exhaust Back Pressure .....	
Black Smoke Exhaust .....	

# EXHAUST SYSTEM

Refer to “ODTNV-EN0033: Section 8. Exhaust System” of TNV Series Application Manual.

## Turbocharger

Engines achieve the most efficient combustion at a certain air-fuel ratio. Although the amount of fuel injection can be increased, the amount of air that can be introduced into the cylinder is limited.

The turbocharger improves the output performance of the engine by compressing the intake air with a compressor. Exhaust gas from the engine is used to drive a gas turbine which in turn drives the compressor. Turbocharged engines are developed by matching the following criteria: the desired output performance, thermal load and durability.

The turbocharger is a precision unit that is operated in high temperature gas, rotating at a rate as high as approximately 150,000 min<sup>-1</sup>. Continuous use of the unit for a long time with excellent performance requires proper handling.

### ■ Structure of turbocharger

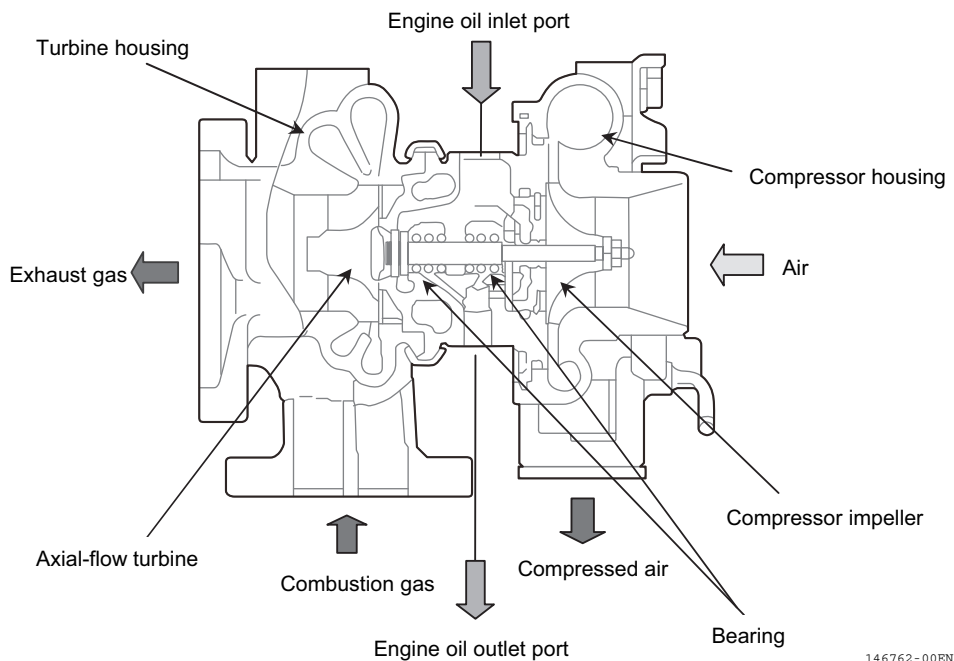
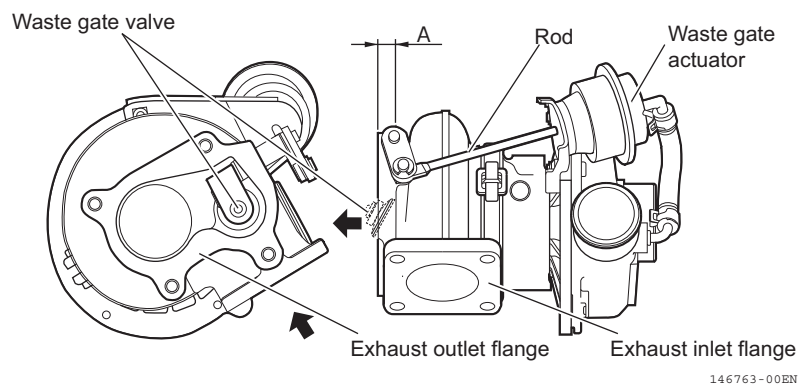


Figure 8-1

## ■ Handling the turbocharger

- Like naturally aspirated engines, turbocharged engines require idling operation for five minutes or more, especially when starting in cold weather (0 °C) or below.  
When an engine is loaded immediately after cold starting, engine oil viscosity is still high which may damage the bearing due to insufficient turbocharger lubrication.  
The engine should also run at idle for a sufficient period of time before stopping the engine. Stopping the engine immediately after loaded operation can lead to damage to the bearing because the lubricant supply stops, causing the component temperature to rise abnormally.
- Engine oil is used as the turbocharger lubricant. For the grade of the lubricant to be used, refer to “*ODTNV-EN0033: Selection of Engine Oil on page 11-5*”.
- Replace engine oil every 250 hours.
- When discharging exhaust gas from the turbocharger directly to the outside, a waste gate valve, located inside the exhaust outlet flange, protrudes from the flange surface during each stroke as shown (**Figure 8-2**). Provide enough space around the waste gate valve to prevent interference.



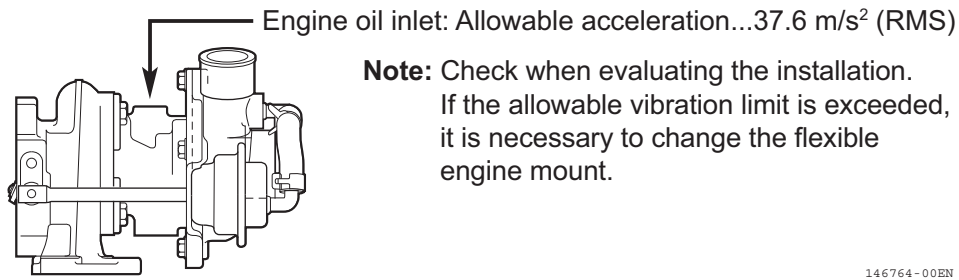
**Figure 8-2**

Applicable model	Protrusion (A)	Required space
3TNV80FT	4.5 mm	8.0 mm

- Do not support the weight of the exhaust system components with the outlet flange. The turbine housing may break or become deformed and cause internal damage.
- When you connect the air hose to the turbocharger, do not apply too much torque to the connection. Excess torque may damage the compressor housing, resulting in internal damage.
- Select an air hose with the proper rigidity and length so that will not become deformed at a negative pressure of 300 kPa (at 80 °C). A deformed hose can cause the turbocharger to overload and damage internal turbocharger components.

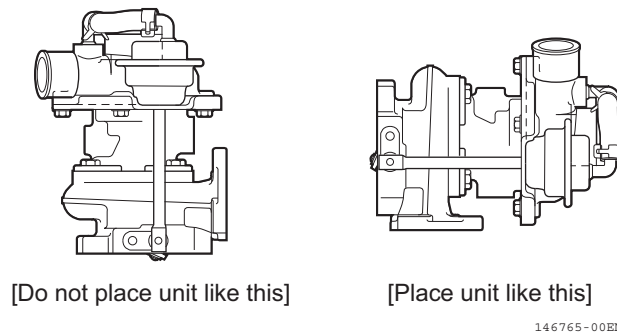
# EXHAUST SYSTEM

- Allowable vibration of turbocharger



**Figure 8-3**

- Running the turbocharger at high speed can cause high frequency rotation noise and fluid noise. The noise occurs out of phase with the engine noise especially during acceleration or deceleration. Consider sound insulation when designing the machine application.
- Remove the turbocharger from the engine to perform maintenance. Be sure to keep the unit horizontal when you remove it from the engine (**Figure 8-4**). Holding the unit vertically can cause engine oil to leak into the compressor housing or turbine housing, leading to abnormal operation after reassembly.



**Figure 8-4**

- Be sure to follow the procedures in the *TNV Service Manual* when you remove the turbocharger from the engine.

For back pressure, contact the person in charge.

## Section 9

# COOLING SYSTEM

---

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Cooling Fan and Its Drive System.....	9-3

## COOLING SYSTEM

Refer to “ODTNV-EN0033: Section 9. Cooling System” of TNV Series Application Manual.

### Radiator

For “Radiator Standard Capacity”, refer to the below table.

#### Radiator Standard Capacity

Nominal heat rejection rate unit: kW

Model	Specification min <sup>-1</sup>	CL		VM										CH			
		1500	1800	2000	2200	2400	2500	2600	2800	3000	3200	3400	3600	3000	3600		
3TNM74F		23.6												28.6			
3TNV74F				23.6													
3TNV80F				23.6										28.6			
3TNV80FT														23.6			
3TNV88F		23.6		28.6													

### Thermostat

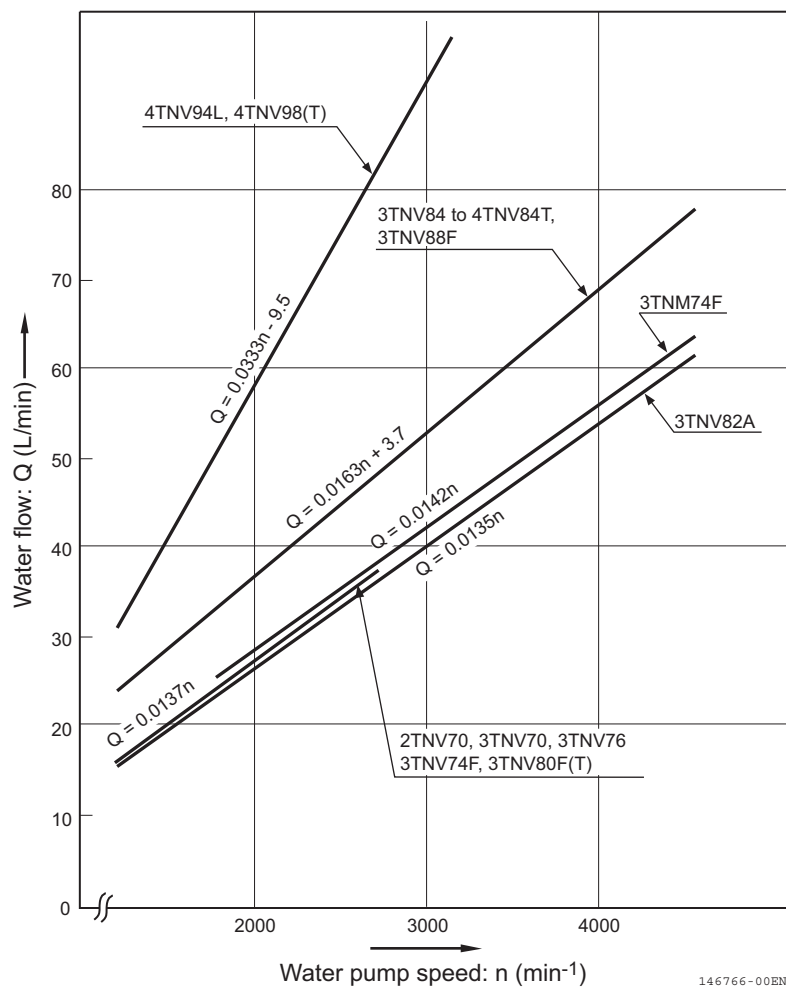
For “Specification”, refer to the below table.

	Standard		(For heater) option	
	3TNM74F 3TNV74F/80F(T)	3TNV88F	3TNM74F 3TNV74F/80F(T)	3TNV88F
Part code	119717-4980X	129155-4980X	119718-4980X	129457-4980X
Thermostat type	Wax pellet type			
Valve opening temperature	71 °C ± 1.5 °C (160 °F ± 1.5 °F)		82 °C ± 1.5 °C (180 °F ± 1.5 °F)	
Full opening temperature	85 °C (185 °F)		95 °C (203 °F)	
Maximum lift	8 mm or more			
Flange diameter D	ø44 mm			
ID color	Blue		Red	
Type	A	B	A	B

## Heat Rejection to Engine Coolant

For “Coolant pump capacity”, refer to the below figure.

### ■ Coolant pump capacity



146766-00EN

## Cooling Fan and Its Drive System

For “Selection of cooling fan”, refer to the below table.

### ■ Selection of cooling fan

Fan dia.	3TNM74F	3TNV74F	3TNV80F(T)	3TNV88F
ø310	✓	✓		
ø335			✓	✓

For “Fan spacer”, refer to the below table.

### ■ Fan spacer

Engine model	Size of spacer (pusher/puller fan) (mm)
3TNM74F, 3TNV74F/80F(T)	18
3TNV88F	25

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**Section 10**

# DIESEL FUEL SYSTEM

---

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# DIESEL FUEL SYSTEM

Refer to "ODTNV-EN0033: Section 10. Diesel Fuel System" of TNV Series Application Manual.

## Standard Diesel Fuel Line Layout

For "Part specification of piping with IDI engine", refer to the below table.

### ■ Parts specification

#### *EPA F-Tier4 specification*

Engine model		3TNM74F, 3TNV74F, 3TNV80F(T)
Diesel fuel pump	(a) Mechanical type	129100-5210X (standard)
	(b) Electric type	119225-5210X (standard)
		129612-5210X (with water proof coupler)
Diesel fuel/water separator		129335-5570X (diesel fuel inlet downward)
		Filter mesh: 100 mesh (with valve)
Main filter		119740-5560X (Filtration accuracy: > 30 μm)

#### *GB4 specification*

Engine model		3TNM74F-S, 3TNV74F-S, 3TNV80F-S
Diesel fuel pump	(a) Mechanical type	—
	(b) Electric type	119225-5210X (standard)
		129612-5210X (with water proof coupler)
Diesel fuel/water separator		129242-5570X (Horizontal fuel inlet)
Pre-filter		129065-5575X (Horizontal fuel inlet)
Main filter		129907-5580X (Filtration accuracy: ≥ 1 μm)

## Section 11

# LUBRICATING SYSTEM

---

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## LUBRICATING SYSTEM

---

Refer to “*ODTNV-EN0033: Section 11. Lubricating System*” of TNV Series Application Manual.

### Engine Oil Cooler

For “Specifications of Engine Oil Cooler”, refer to the below table.

#### Specifications of Engine Oil Cooler

Code No.		119717-3302X	129508-3303X
Exchangeable heat amount	kW	3.2	4.0
Applicable engine models		(3TNM74F) (3TNV74F) (3TNV80F(T))	(3TNV88F)

## Section 12

# MATCHING TEST PROCEDURE

---

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## **MATCHING TEST PROCEDURE**

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Refer to “*ODTNV-EN0033: Section 12. Matching Test Procedure*” of TNV Series Application Manual.

### **Instructions for Mounting Measuring Instruments**

#### **■ Engine speed measurement (8)**

As you cannot measure with the speed pickup from the fuel filler port of the gear case lubricating oil, measure with the utilization of the vibration of the fuel injection high pressure lines.

## Section 13

# ELECTRICAL SYSTEM

---

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## ELECTRICAL SYSTEM

---

Refer to “*ODTNV-EN0033: Section 13. Electrical System*” of TNV Series Application Manual.

# Wiring

## Wiring Diagram for IDI Engine

### ■ 3TNM74F, 3TNV74F, 3TNV80F

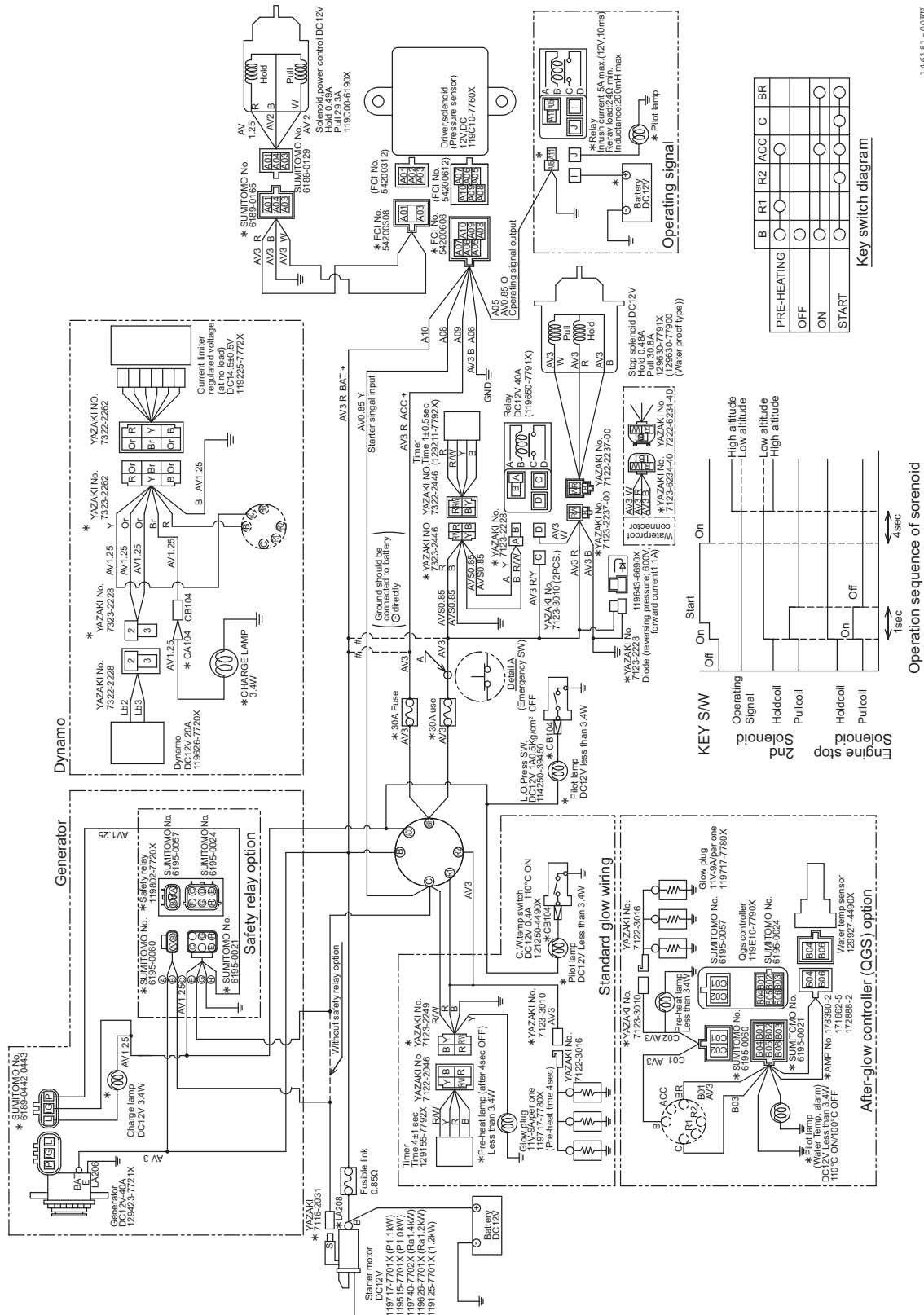


Figure 13-1

From YANMAR wiring diagram E3-19C10-0030 (Ask YANMAR for the newest diagram)



# Wiring Diagram for DI Engine

## 3TNV88F-U

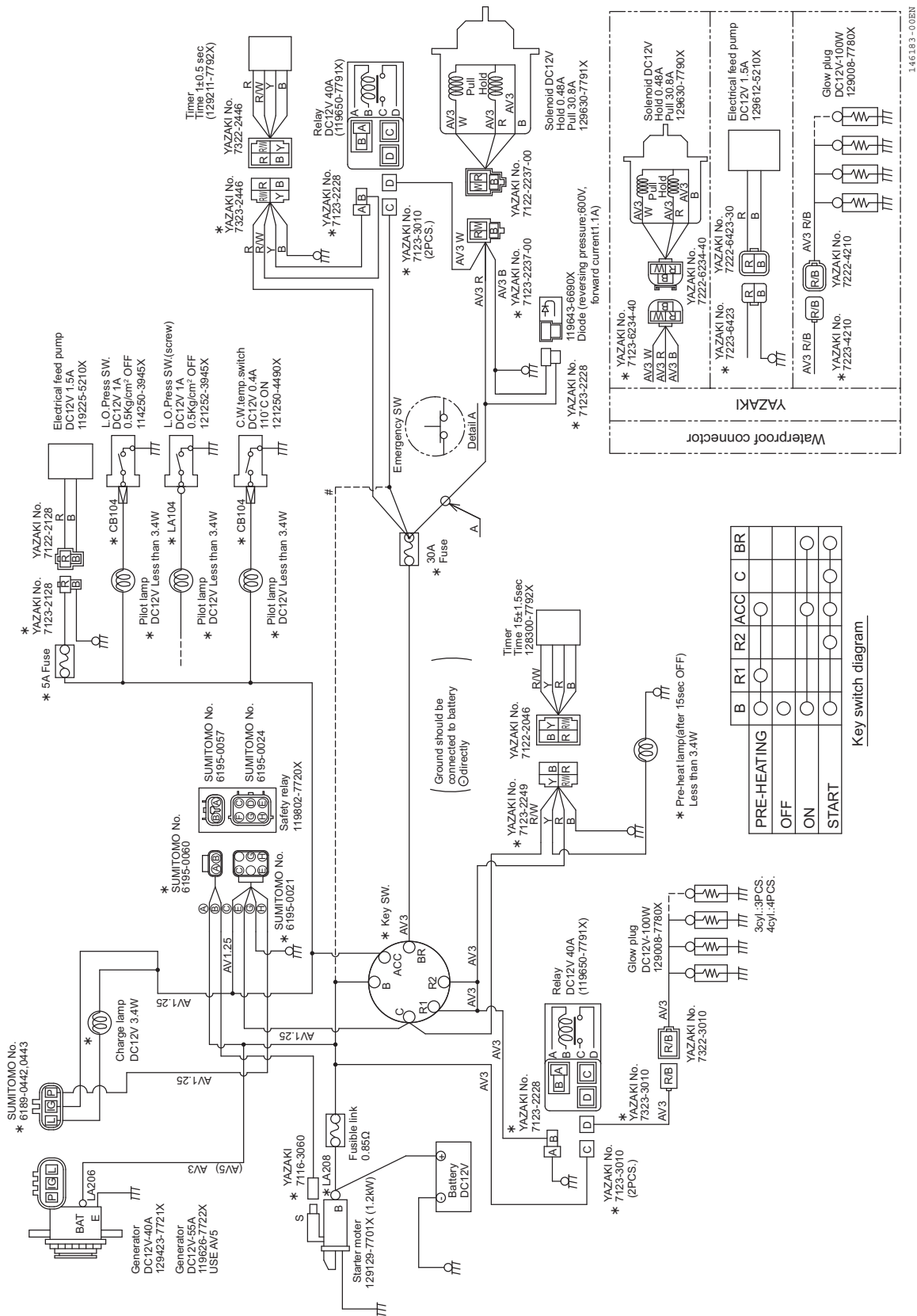


Figure 13-3

From YANMAR wiring diagram E3-29005-0010 (Ask YANMAR for the newest diagram)

# ELECTRICAL SYSTEM

## 3TNV88F-E

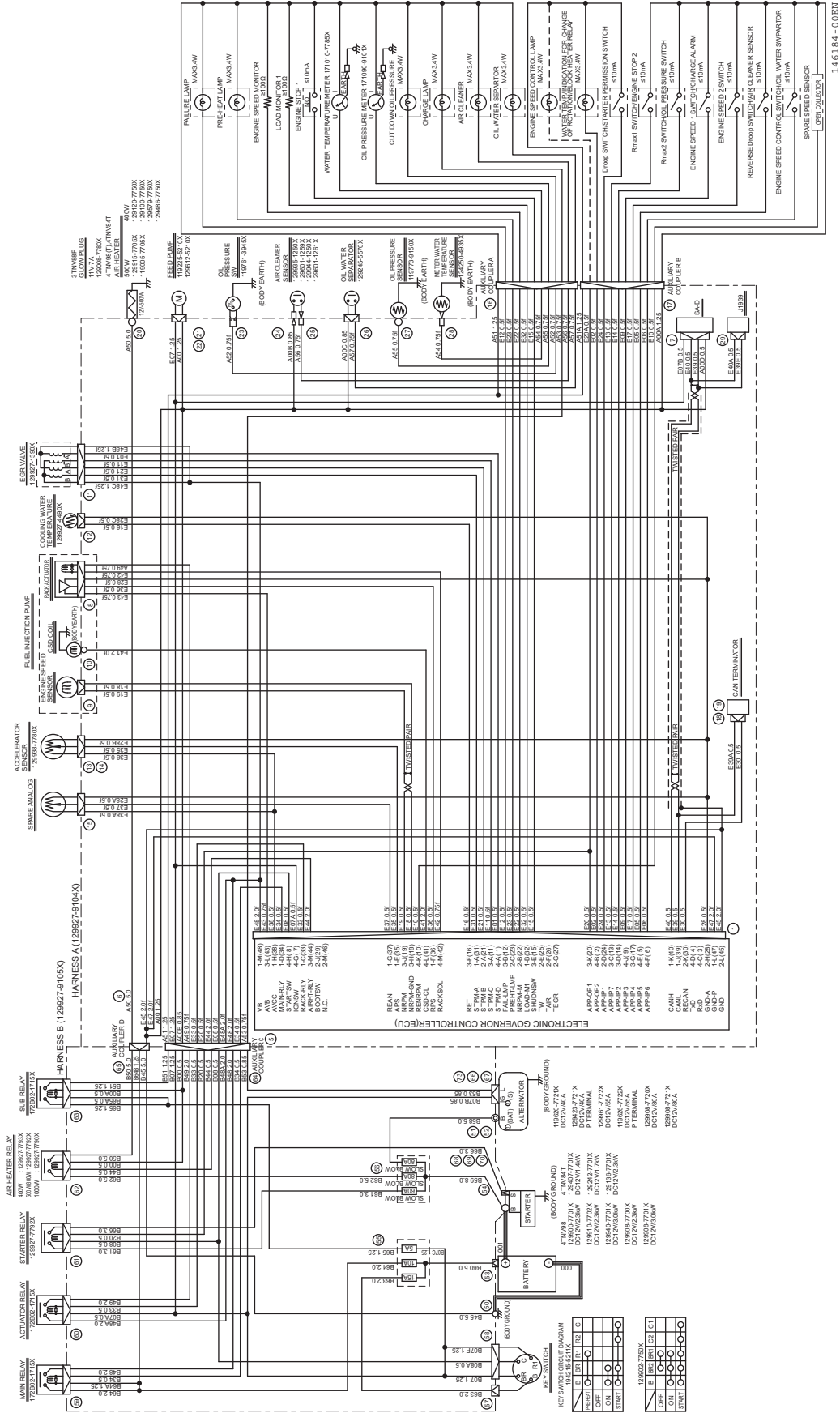


Figure 13-4

From YANMAR wiring diagram E3-29927-0042 (Ask YANMAR for the newest diagram)

## Section 14

# ELECTRONIC CONTROL SYSTEM

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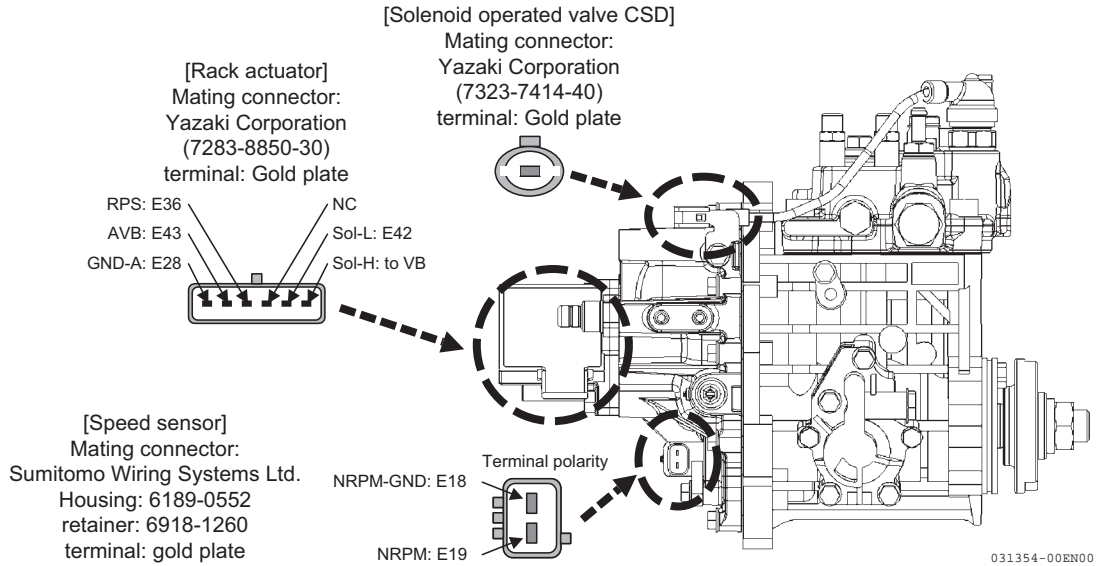
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# ELECTRONIC CONTROL SYSTEM

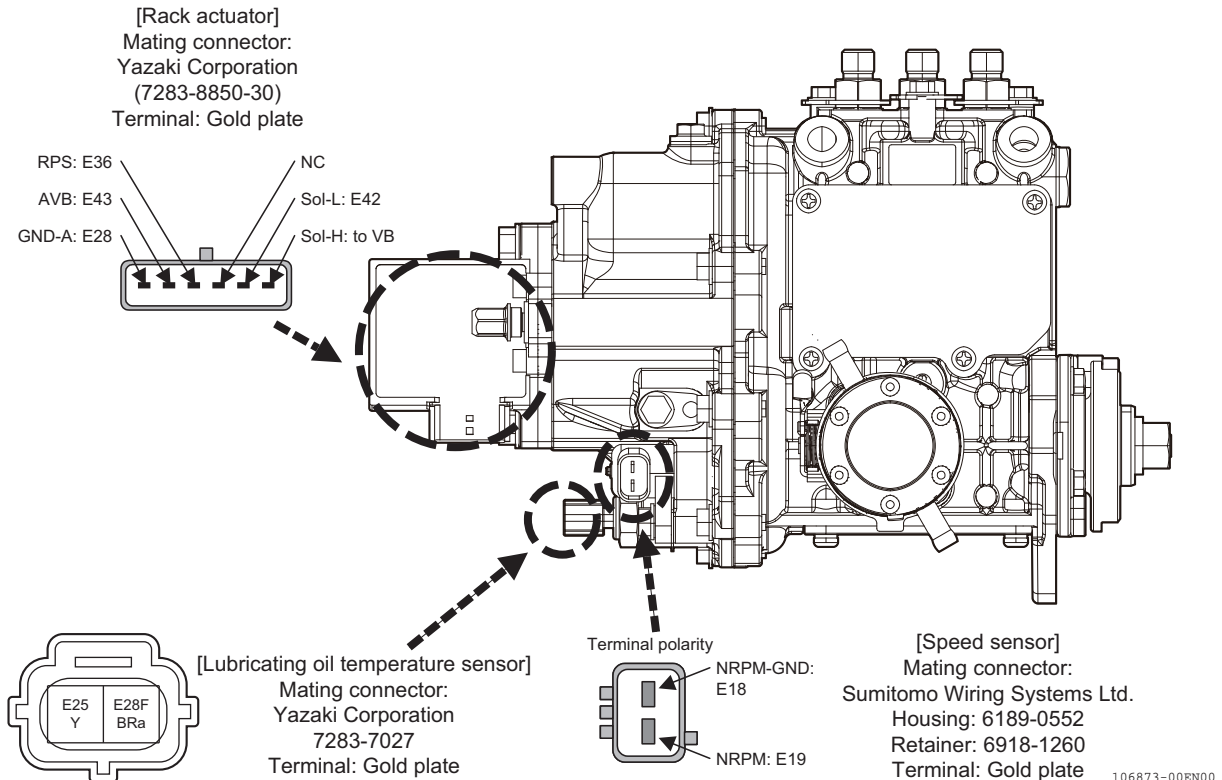
Refer to "ODTNV-EN0033: Section 14. Electronic Control System" of TNV Series Application Manual.  
Applicable engines are only 3TNV80FT-Z and 3TNV88F-E.

## Fuel Injection Pump

When creating a harness, correctly identify the polarity of the rack actuator solenoid and speed sensor.



**Figure 14-1 Connectors compatible with the fuel injection pump (3TNV80FT-Z)**



**Figure 14-2 Connectors compatible with the fuel injection pump (3TNV80FT-Z)**

## Lubricating Oil Temperature Sensor

The thermistor temperature sensor used for the ECO governor control of 3TNV80FT-Z engines is used for measuring lubricating oil temperature.

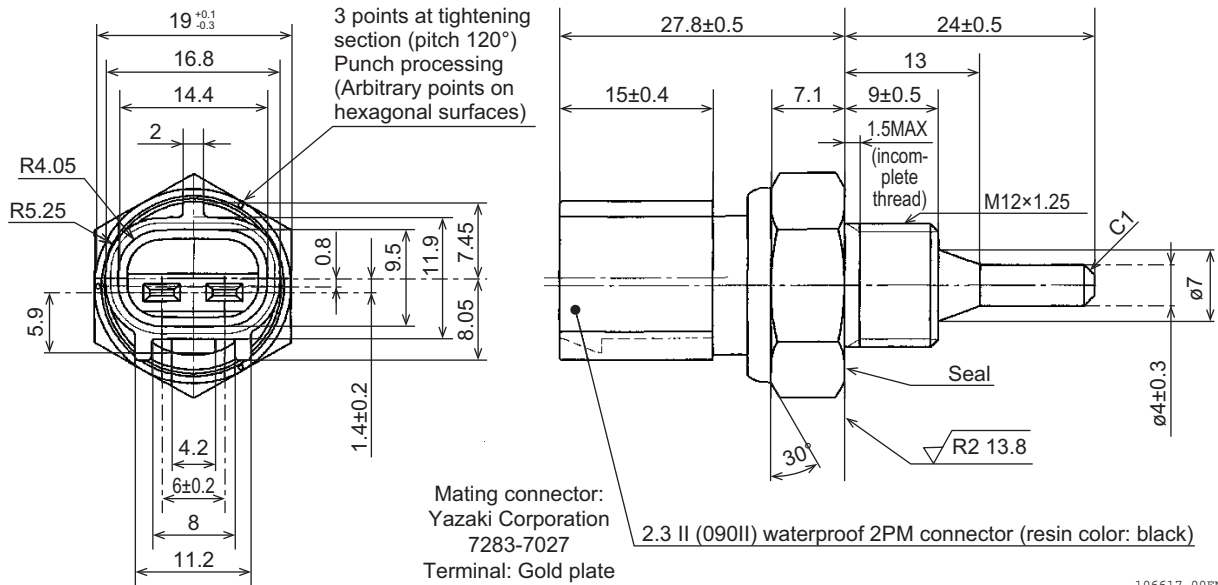


Figure 14-3 Lubricating oil temperature sensor (119E11-3944X)

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**Section 15**

# ON-VEHICLE COMMUNICATION CAN SPECIFICATION

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## ON-VEHICLE COMMUNICATION CAN SPECIFICATION

---

Refer to “*ODTNV-EN0033: Section 15. On-Vehicle Communication CAN Specification*” of TNV Series Application Manual.

*Note: The subject engine is 3TNV88F-E only.*

## Section 16

# P.T.O. SYSTEMS

---

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Refer to “ODTNV-EN0033: Section 16. P.T.O. Systems” of TNV Series Application Manual.

## Direct Coupled P.T.O. Configurations

For “Allowable torque from front P.T.O. (direct coupling)”, refer to the below table.

### Allowable torque from front P.T.O. (direct coupling)

Model	Allowable torque N·m (kgf·m)
3TNM74F, 3TNV74F	27 (2.8)
3TNV80F(T)	30 (3.1)
3TNV88F	43 (4.4)

For “Allowable thrust load”, refer to the below table.

### ■ Allowable thrust load

Unit: N (kgf)

Engine model name	Static thrust load	Dynamic thrust load
3TNM74F, 3TNV74F	1568 (160)	784 (80)
3TNV80F(T)	1764 (180)	882 (90)
3TNV88F	2842 (290)	1372 (140)

For “Maximum bending moment at the coupling face of flywheel housing (N·m)”, refer to the below table.

Engine model name	Max: Maximum bending moment at the coupling face of flywheel housing (N·m)	Housing type
3TNM74F	980	SAE #5
3TNV74F		
3TNV80F(T)		
3TNV88F	1770	

# Allowable Side Load for Main P.T.O.

■ 3TNM74F

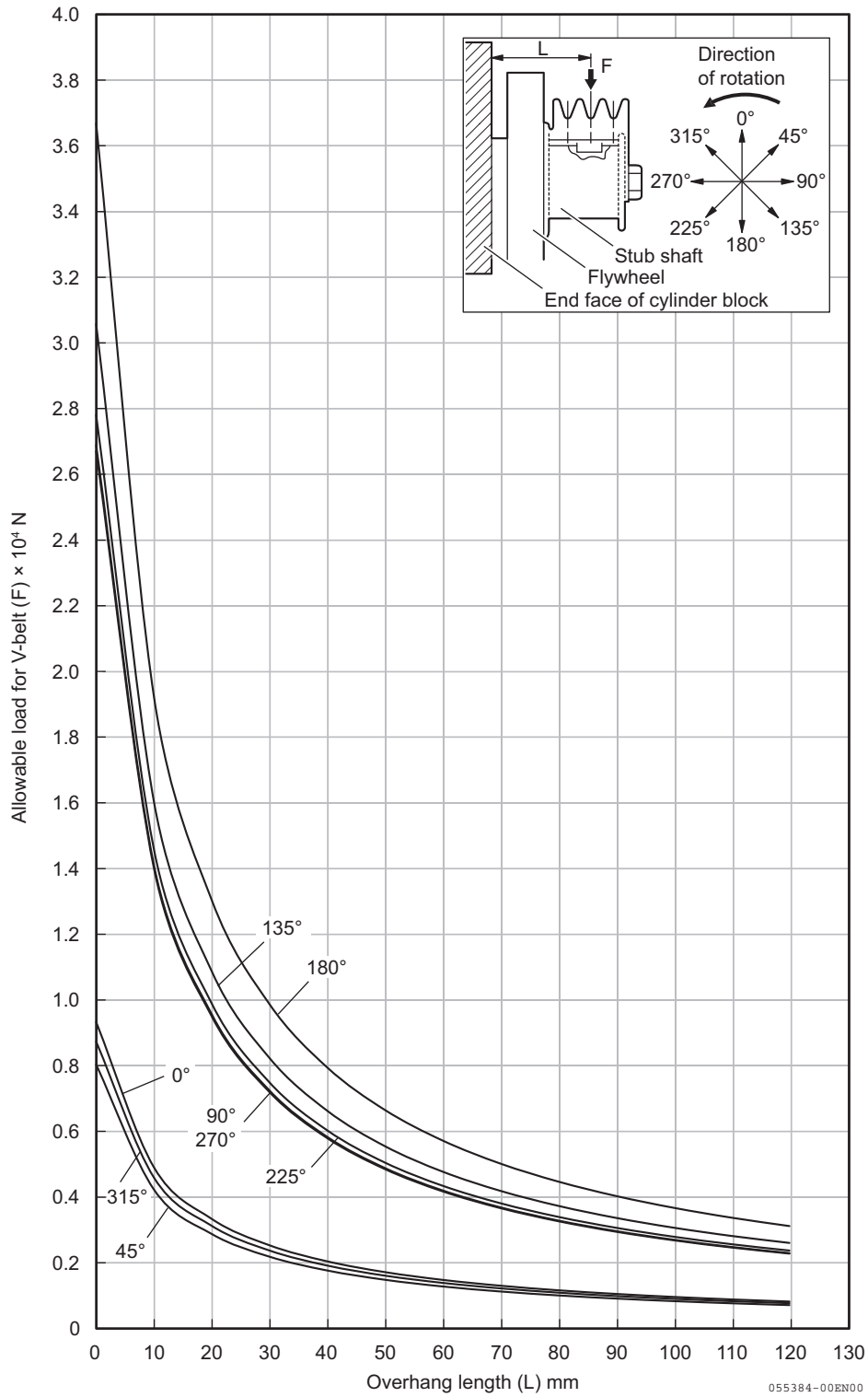


Figure 16-1

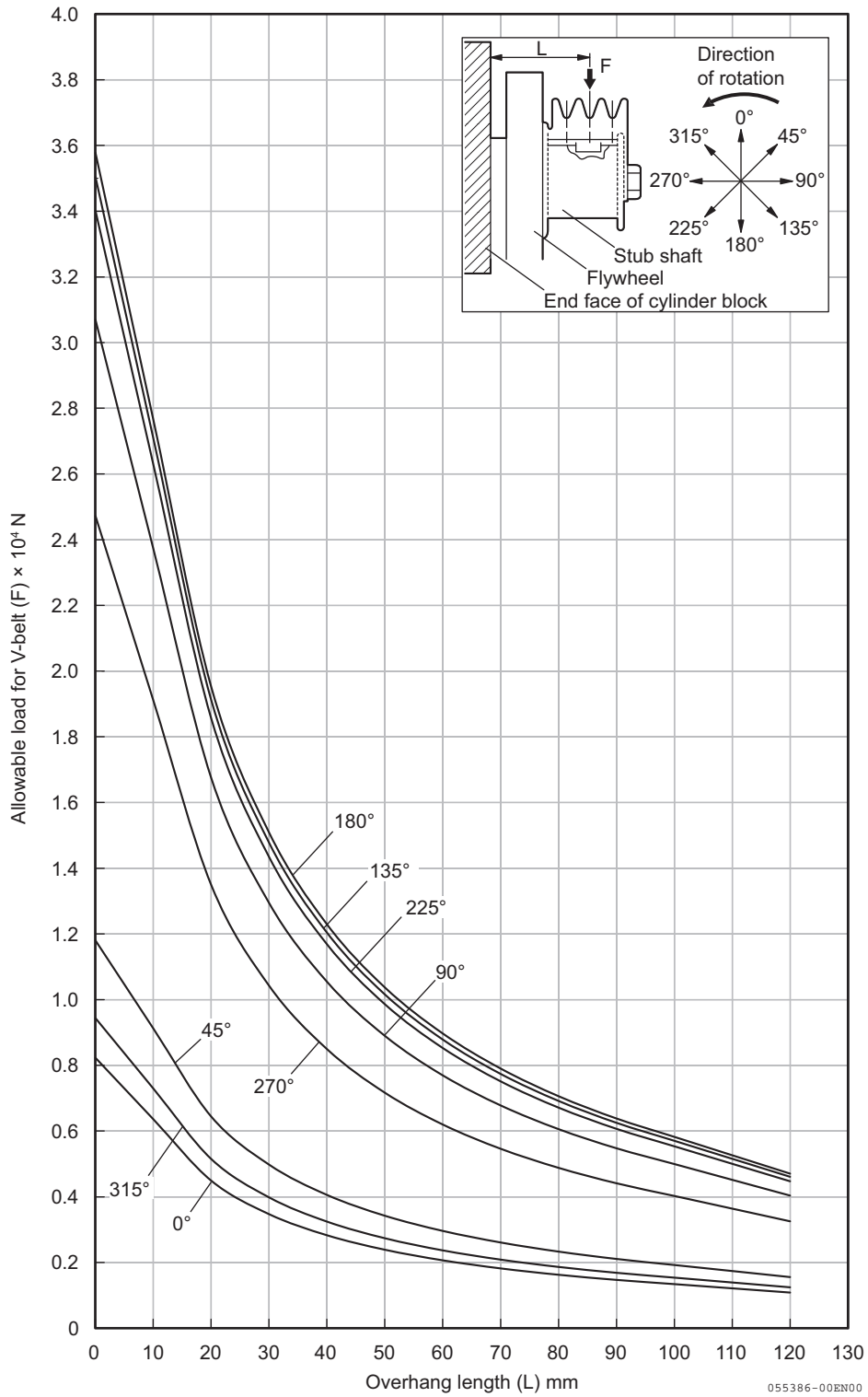


Figure 16-2

■ 3TNV80F(T)

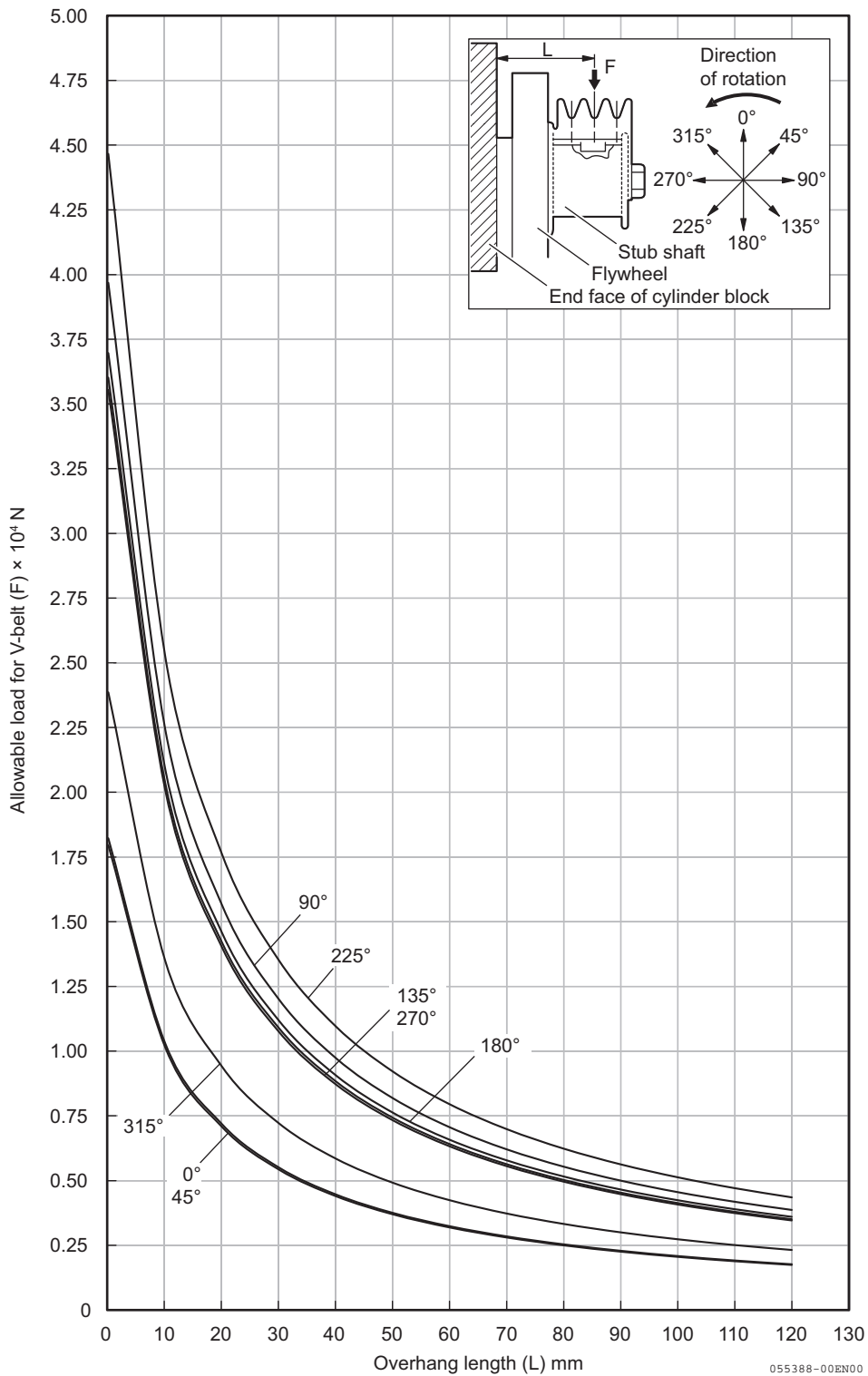


Figure 16-3

### ■ 3TNV88F

Refer to “0DTNV-EN0033: Specifications of Standard Engines for Machines” of TNV Series Application Manual.

# Allowable Side Load for Front P.T.O.

## ■ 3TNM74F

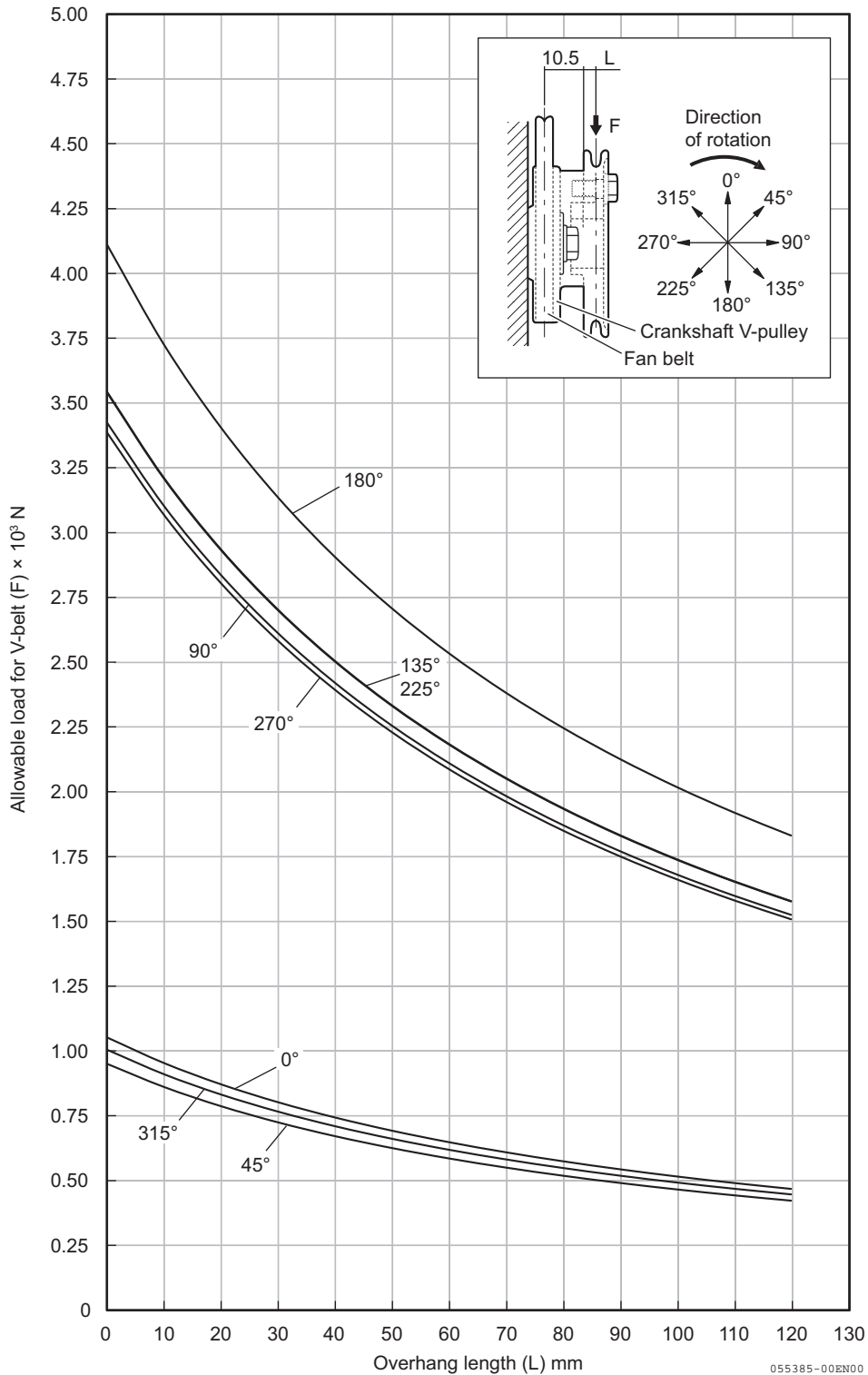


Figure 16-4

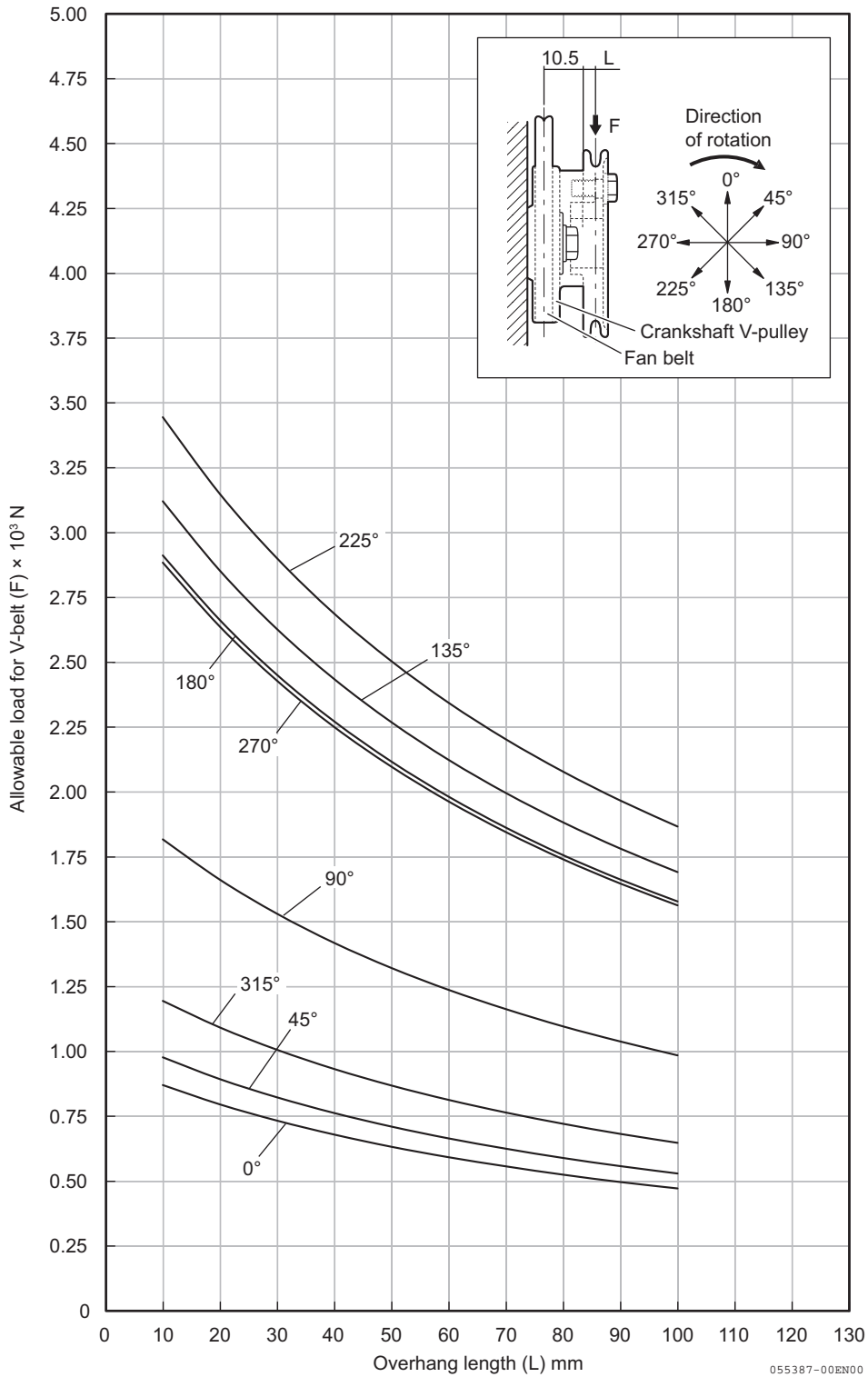


Figure 16-5

■ 3TNV80F(T)

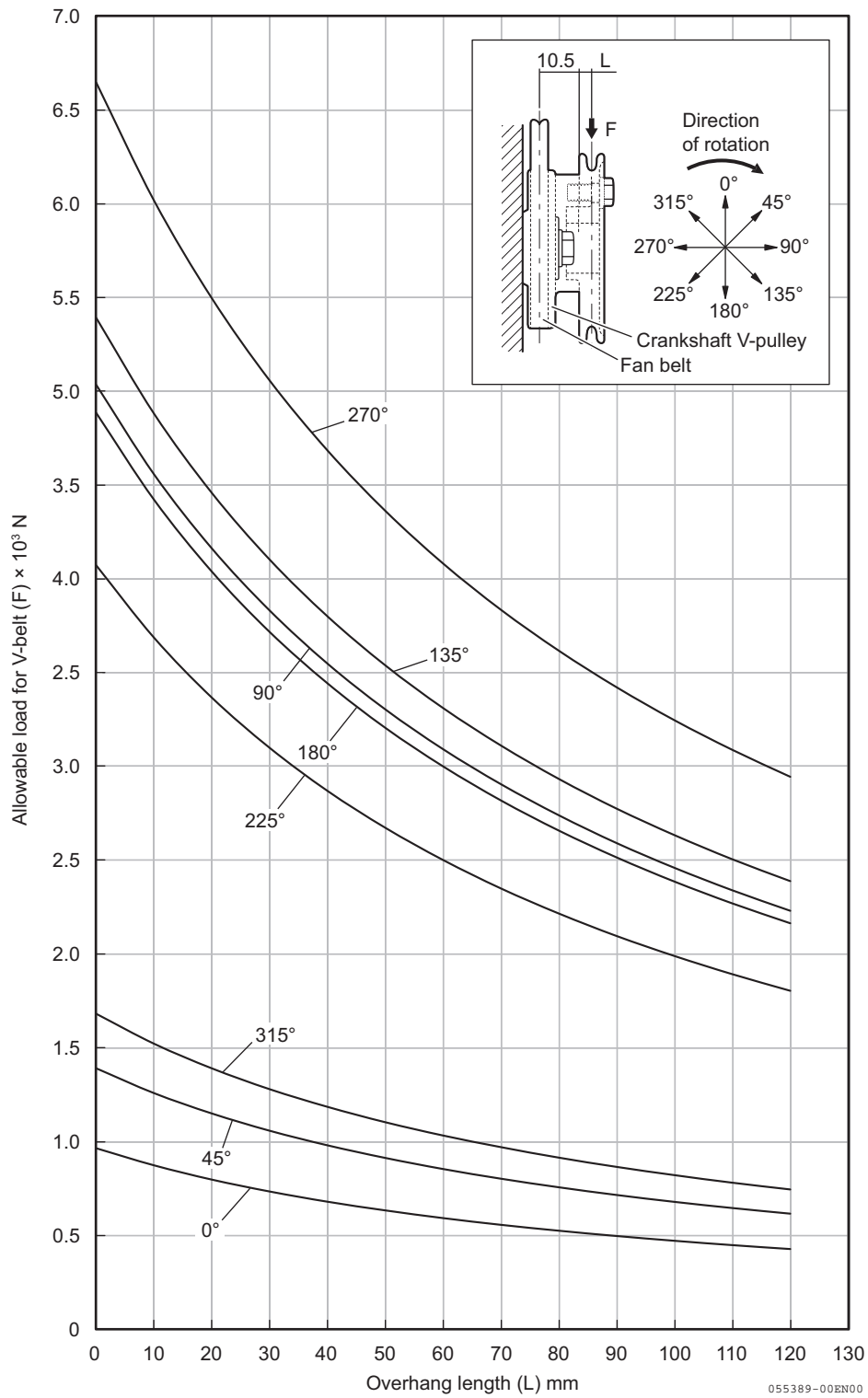


Figure 16-6

## P.T.O. SYSTEMS

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### ■ 3TNV80F(T)

Refer to “0DTNV-EN0033” of TNV Series Application Manual.

## Cautions for Hydraulic Pump Drive P.T.O. on the Gear Case

For "Gear Train", refer to the below table.

### Gear Train

Code	Name		Number of teeth	
			3TNV74F 3TNV80F(T)	3TNV88F
A	Crank gear	<input type="checkbox"/>	31	28
B	Idle gear	<input type="checkbox"/>	61	43
C	Fuel pump drive gear	<input type="checkbox"/>	62	56
D	Cam gear	<input type="checkbox"/>	62	56
E	Hydraulic pump drive gear	<input checked="" type="checkbox"/>	37	31
F	Lubricating oil pump drive gear	<input type="checkbox"/>	–	–
Gear ratio: A/E			0.838	0.903
Hydraulic pump position: W/H (mm)			138/80	162.3/65.979

: Standard part

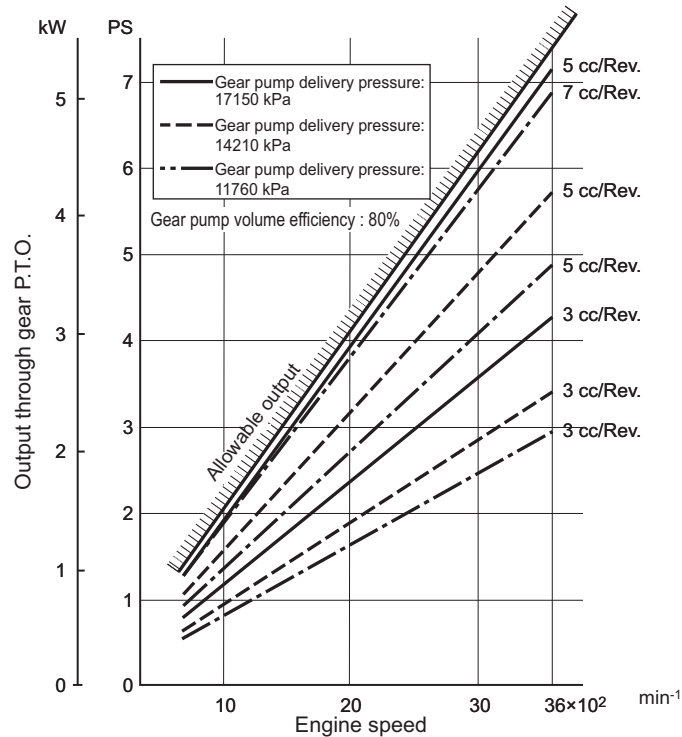
: Option part

## Allowable Load for Hydraulic Pump Drive P.T.O.

For “Allowable Load for Hydraulic Pump Drive P.T.O.”, refer to the below figure.

### IDI Series

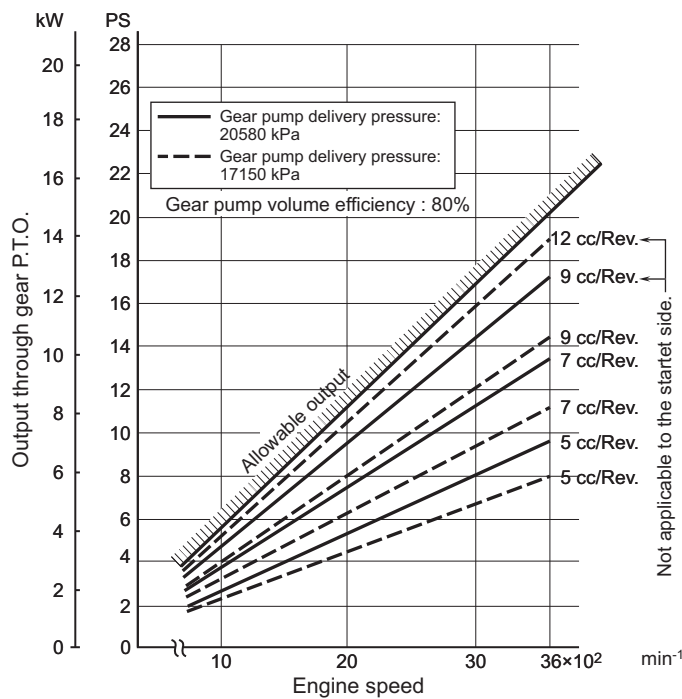
#### ■ 3TNV74F, 3TNV80F(T)



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### DI Series

#### ■ 3TNV88F



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**Section 17**

# VIBRATION ISOLATION SYSTEM

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# VIBRATION ISOLATION SYSTEM

Refer to “ODTNV-EN0033: Section 17. Vibration Isolation System” of TNV Series Application Manual.

## Vibration Isolation Materials

For “Excitation Force: Unbalance force”, refer to the below table.

### Excitation Force

#### ■ Unbalance force

Engine model	1st order inertia force by reciprocating mass	2nd order inertia force by reciprocating mass	1st order couple force by rotating mass	1st order couple force by reciprocating mass	2nd order couple force by reciprocating mass
	$F_z$ (N)*1	$F_z$ (N)*2	$N_{oz}$ (N·m)*1	$N_{py}$ (N·m)*1	$N_{py}$ (N·m)*2
3TNM74F	–	–	$2.41 \times 10^{-6} \times N^2$	$34.40 \times 10^{-6} \times N^2$	$11.72 \times 10^{-6} \times N^2$
3TNV74F	–	–	$6.99 \times 10^{-6} \times N^2$	$34.40 \times 10^{-6} \times N^2$	$11.72 \times 10^{-6} \times N^2$
3TNV80F(T)	–	–	$15.14 \times 10^{-6} \times N^2$	$49.73 \times 10^{-6} \times N^2$	$17.12 \times 10^{-6} \times N^2$
3TNV88F	–	–	$22.928 \times 10^{-6} \times N^2$	$89.967 \times 10^{-6} \times N^2$	$29.557 \times 10^{-6} \times N^2$

\*1: With unbalance moment to V-pulley and flywheel

\*2: Without unbalance moment to V-pulley and flywheel

For “Excitation Force: Torque alternation by gas pressure”, refer to the below table.

#### ■ Torque alternation by gas pressure

Engine model	Torque alternation $T$ (N·m)					
	1/2 order	1st order	1-1/2 order	2nd order	3rd order	4th order
3TNM74F	–	–	134.9	–	85.2	–
3TNV74F	–	–	129.5	–	84.2	–
3TNV80F	–	–	167.7	–	108.1	–
3TNV80F(T)	–	–	217.4	–	111.8	–
3TNV88F	–	–	273.6	–	145.1	–

For “Engine Weight and Center of Gravity in 3TNM74F, 3TNV74F, 3TNV80F(T) and 3TNV88F”, refer to the below table.

### Engine Weight and Center of Gravity

	<i>L</i> (mm)	<i>M</i> (mm)	<i>N</i> (mm)	<i>W</i> (kg)
3TNM74F	145.5	95.5	4.5	91
3TNV74F	200.5	89	4.5	103
3TNV80F	198	80.5	5.5	121
3TNV80FT	122.7	87.7	9.4	127
3TNV88F	223	98.7	-5.3	162

For “Engine Moment of Inertia in 3TNM74F, 3TNV74F, 3TNV80F(T) and 3TNV88F”, refer to the below table.

### Engine Moment of Inertia

	Moment of inertia (kg-m <sup>2</sup> )			Wet weight (kg)
	<i>I<sub>x</sub></i>	<i>I<sub>y</sub></i>	<i>I<sub>z</sub></i>	<i>W</i>
3TNM74F	1.5	2.2	1.6	91
3TNV74F	1.9	2.7	2.0	103
3TNV80F	2.3	3.6	2.7	121
3TNV80FT	3.1	4.3	3.2	127
3TNV88F	4.7	6.3	4.4	162

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## Section 18

# TORSIONAL VIBRATION

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# TORSIONAL VIBRATION

Refer to "ODTNV-EN0033: Section 18. Torsional Vibration" of TNV Series Application Manual.

## Torsional Vibration Equivalent Vibration System

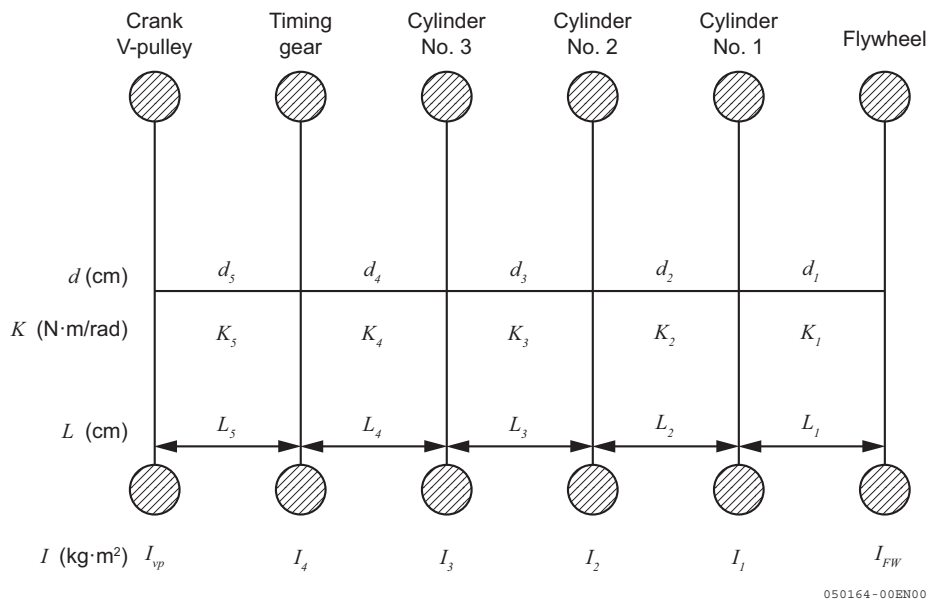


Figure 18-1

$I_n$ : Moment of inertia  $\text{kg}\cdot\text{m}^2$

	$I_4$	$I_3$	$I_2$	$I_1$
3TNM74F	$2.98 \times 10^{-4}$	$3.85 \times 10^{-3}$	$2.12 \times 10^{-3}$	$3.77 \times 10^{-3}$
3TNV74F	$6.80 \times 10^{-4}$	$3.55 \times 10^{-3}$	$1.97 \times 10^{-3}$	$3.56 \times 10^{-3}$
3TNV80F(T)	$6.80 \times 10^{-4}$	$5.74 \times 10^{-3}$	$3.11 \times 10^{-3}$	$5.75 \times 10^{-3}$
3TNV88F	$1.61 \times 10^{-3}$	$9.72 \times 10^{-3}$	$5.13 \times 10^{-3}$	$9.72 \times 10^{-3}$

	Crank V-pulley		Flywheel	
	$I_{VP}$	Code No.	$I_{FW}$	Code No.
3TNM74F	$1.82 \times 10^{-3}$	119125-2165X	$7.11 \times 10^{-2}$	119127-2159X
3TNV74F	$1.44 \times 10^{-3}$	119C00-2165X	$1.03 \times 10^{-1}$	119C10-2159X
3TNV80F(T)	$1.44 \times 10^{-3}$	119C00-2165X	$1.97 \times 10^{-1}$	119E00-2158X
3TNV88F-U	$2.16 \times 10^{-3}$	129004-2165X	$4.35 \times 10^{-1}$	171340-2159X
3TNV88F-E			$3.30 \times 10^{-1}$	171350-2159X

***K: Spring constant N·m/rad***

	$K_5$	$K_4$	$K_3$	$K_2$	$K_1$
3TNM74F	0.113	0.329	0.255	0.255	0.400
3TNV74F	0.167	0.281	0.274	0.274	0.449
3TNV80F(T)	0.171	0.301	0.317	0.317	0.501
3TNV88F	0.316	0.341	0.423	0.423	0.653

***L: Equivalent length N·m/rad***

	$L_5$	$L_4$	$L_3$	$L_2$	$L_1$
3TNM74F	86.95	29.76	38.39	38.39	24.52
3TNV74F	58.54	34.90	35.79	35.79	21.85
3TNV80F(T)	57.38	32.57	30.94	30.94	19.55
3TNV88F	30.98	28.76	23.15	23.15	15.00

***d: Shaft diameter cm***

	$d_5$	$d_4$	$d_3$	$d_2$	$d_1$	Equivalent shaft diameter
3TNM74F	2.7	2.7	4.4	4.4	4.4	18.72
3TNV74F	2.9	2.9	4.7	4.7	4.7	18.72
3TNV80F(T)	2.9	2.9	4.7	4.7	4.7	18.72
3TNV88F	3.8	3.8	5.0	5.0	5.0	18.72

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## Section 19

# REFERENCE MATERIALS

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## REFERENCE MATERIALS

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Refer to “*ODTNV-EN0033: Section 19. Reference Materials*” of TNV Series Application Manual.

## ***Section 20***

# CONVERSION FACTORS FOR SI UNITS

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Refer to “*ODTNV-EN0033: Section 20. Conversion Factors for SI Units*” of TNV Series Application Manual.

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As of April 1, 2020

## **APPLICATION MANUAL**

3TNM74F, 3TNV74F, 3TNV80F,  
3TNV80FT, 3TNV88F

1st edition: October 2012  
1st edition 1st rev.: July 2013  
2nd edition: August 2017  
3rd edition: March 2023

Issued by: YANMAR POWER TECHNOLOGY CO., LTD.

Edited by: YANMAR GLOBAL CS CO., LTD.



**YANMAR POWER TECHNOLOGY CO., LTD.**

<https://www.yanmar.com>

ODTNV-EN0112  
Mar.2023-0  
PRINTED IN JAPAN