TOSHIBA

TOSVERT   VF Series

Adaptation manual for IE3 motors

Contents

1. INTRODUCTION

In Japan, the motors from 0.75kW to 375kW which are shipped by manufacturers and the imported motors have been changed to IE3 motors since April 2015.

According to this change, Toshiba standard motors have also been changed to IE3 motors (Premium Gold Motor).

In case of using IE3 motors by inverters which have motor parameters of IE1 motors, you can get better characteristics by setting the motor parameters properly.

Please set them according to this manual.

2. Procedure for IE3 motor parameters setting

2.1. In case of Toshiba standard IE3 motors (Premium Gold Motor)

The motor parameters of Toshiba standard IE3 motors (4 pole) for each models are shown in Table 1.1 and Table 1.2.

Table 1.1 is for 200V models. (Base frequency voltage1 is 200V)

Table 1.2 is for 400V models. (Base frequency voltage1 is 400V)

Please set the motor parameters according to this procedure for each models which are described in the Table1.1 and Table 1.2.

Regarding the following case, please set the motor parameters by procedure in 2.2 section with reference to the motor name plate or test report.

- Other than 4 pole motor

- Other than the Base frequency voltage1 is 200V or 400V

- Motor which data are not described in the Table1.1 and Table 1.2.

- In case of the data of "-" in the Table1.1 and Table 1.2.

2.1.1. Setting of V/F parameters

Set the Base frequency1 and the Base frequency voltage1.

Title	Communication No.	Function
$u L$	0014	Base frequency 1
$u L u$	0409	Base frequency voltage 1

Regardless of the V/F control mode selection (pt), please set the below parameters from Table 1.1 and Table 1.2.

- In case of Pt =0,1(Common), only set the Torque boost value1($u b$).

- In case of Pt =5(VF-AS1/VF-PS1), 7(VF-S15), set the parameters $F190$～$F199$ for V/F 5-point setting and set $u b$.

- In case of Pt =2,3(Common), 4(Except for VF-PS1), 5(VF-S15), 7(VF-AS1/VF-PS1), 8(VF-AS1), 9, 10(VF-PS1), proceed to 2.1.2 section.

2.1.2. Perform the Auto-tuning

In case of the following V/F control mode selection (pt), Auto-tuning is required.

Please perform the Auto-tuning according to the next page procedure.

VF-AS1

Automatic torque boost ($P t$ =2), Sensorless vector control1 ($P t$ =3), Sensorless vector control2 ($P t$ =4),

PG feedback control ($P t$ =7), PG feedback vector control ($P t$ =8)

VF-PS1

Automatic torque boost ($P t$ =2), Sensorless vector control1 ($P t$ =3), PG feedback control ($P t$ =7),

Energy-saving ($P t$ =9), Advanced energy-saving ($P t$ =10)

VF-S15

Automatic torque boost control ($P t$ =2), Vector control ($P t$ =3), Energy-saving ($P t$ =4),

Dynamic energy-saving ($P t$ =5)

VF-FS1

Automatic torque boost control ($P t$ =2), Vector control ($P t$ =3), Advanced energy-saving ($P t$ =4)

VF-nC3

Automatic torque boost control ($P t$ =2), Vector control ($P t$ =3), Advanced energy-saving ($P t$ =4)

Procedure1. Setting of motor prameters

      (1)   Set 50Hz or 60Hz to $u L$ (Base frequency1).

      (2)   Set 200V or 400V to $u L u$ (Base frequency voltage1).

      (3)   Set the motor parameters of Table1.1 and Table1.2.

           Please set the below parameters from Table1.1 and Table 1.2.

VF-AS1, VF-PS1

Title	Communication No.	Function
F405	0405	Motor rated capacity
F406	0406	Motor rated current
F407	0407	Motor rated rotational speed
F413	0413	Motor constant 4 (rated slip)

VF-S15, VF-FS1, VF-nC3

Title	Communication No.	Function
F405	0405	Motor rated capacity
F415	0415	Motor rated current
F417	0417	Motor rated speed

  Regarding the following case, please set the motor parameters by procedure in 2.2 section with reference to the motor name plate or test report.

-    Other than 4 pole motor

-    Other than the Base frequency voltage1 is 200V or 400V

-    Motor which data are not described in the Table1.1 and Table 1.2.

-    In case of the data of "-" in the Table1.1 and Table 1.2.

Procedure2. Connect the motor and perform the Auto-tuning

      (1)   Set 4 to $F400$ (Auto-tuning).

           Some of the parameters will be calculated automatically. (VF-AS1, VF-PS1, VF-S15 only)

      (2)   Set 2 to $F400$ (Auto-tuning).

           After setting, some of the parameters will be tuned to match the motor at the first operation.

  If the Auto-tunig error (Etn、$Etn\ 1\sim3$) occurs at Auto-tuning, please refer to the countermeasure of the instruction manual of each models.

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Table 1.1　200V models (In case of Base frequency voltage1 is 200V: uLu =200(V))

Type	Torque boost value1 (%)	Automatic torque boost value (%)	Motor rated current (A)		Motor rated speed (min-1)		Rated slip (%)	
VFAS1 / VFPS1	_ub_	_F410_	_F406_		_F407_		_F413_	
VFS15 / VFnC3 / VFFS1	_ub_	_F402_	_F415_		_F417_			
Form			uL =50	uL =60	uL =50	uL =60	uL =50	uL =60
S1007 S2007 2007	4.8	4.3	3.8	3.4	1440	1730	4.00	3.89
S2015 2015	4.8	4.4	6.8	6.4	1445	1740	3.56	3.33
S2022 2022	3.1	2.9	10.6	9.4	1460	1755	2.67	2.50
2037	3.1	2.8	15.6	14.6	1460	1755	2.67	2.50
2055	2.5	2.3	23.4	21.4	1465	1760	2.33	2.22
2075	2.3	2.0	30.8	28.6	1460	1755	2.67	2.50
2110	1.8	1.6	46.0	42.0	1475	1770	1.67	1.67
2150	1.6	1.5	58.8	55.6	1470	1760	2.00	2.22
2185	1.5	1.4	74.0	69.0	1475	1770	1.67	1.67
2220	1.7	1.6	84.0	80.0	1470	1760	2.00	2.22
2300	1.4	1.2	114	108	1470	1765	2.00	1.94
2370	0.9	0.8	144	132	1480	1775	1.33	1.39
2450	0.8	0.7	172	159	1480	1775	1.33	1.39
2550	0.8	0.8	200	192	1480	1775	1.33	1.39
2750	1.4	1.3	-	-	-	-	-	-
2900	1.3	1.2	-	-	-	-	-	-
2110K	1.0	0.9	-	-	-	-	-	-
2132K	0.8	0.8	-	-	-	-	-	-

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Table 1.2   400V models (In case of Base frequency voltage1 is 400V: $ьLυ$=400(V))

Type	Torque boost value1 (%)	Automatic torque boost value (%)	Motor rated current (A)		Motor rated speed (min-1)		Rated slip (%)	
VFAS1	$ьb$	$F410$	$F406$		$F407$		$F413$	
VFPS1								
VFS15	$ьb$	$F402$	$F415$		$F417$			
VFnC3								
VFFS1								
Form			$ьL$=50	$ьL$=60	$ьL$=50	$ьL$=60	$ьL$=50	$ьL$=60
4007	4.8	4.3	1.9	1.7	1440	1730	4.00	3.89
4015	4.8	4.4	3.4	3.2	1445	1740	3.56	3.33
4022	3.1	2.9	5.3	4.7	1460	1755	2.67	2.50
4037	3.1	2.8	7.8	7.3	1460	1755	2.67	2.50
4055	2.5	2.3	11.7	10.7	1465	1760	2.33	2.22
4075	2.3	2.0	15.4	14.3	1460	1755	2.67	2.50
4110	1.8	1.6	23.0	21.0	1475	1770	1.67	1.67
4150	1.6	1.5	29.4	27.8	1470	1760	2.00	2.22
4185	1.5	1.4	37.0	34.5	1475	1770	1.67	1.67
4220	1.7	1.6	42.0	40.0	1470	1760	2.00	2.22
4300	1.4	1.2	57.0	54.0	1470	1765	2.00	1.94
4370	0.9	0.8	72.0	66.0	1480	1775	1.33	1.39
4450	0.8	0.7	86.0	79.5	1480	1775	1.33	1.39
4550	0.8	0.8	100	96.0	1480	1775	1.33	1.39
4750	1.4	1.3	-	-	-	-	-	-
4900	1.3	1.2	-	-	-	-	-	-
4110K	1.0	0.9	-	-	-	-	-	-
4132K	0.8	0.8	-	-	-	-	-	-

2.2. In case of other than Toshiba standard IE3 motors (4pole)

For adaptation other than Toshiba standard IE3 motors (4pole), the motor parameters setting are required.

Please set them refer to motor name plate or test report.

Even if you use Toshiba standard IE3 motors (4-pole), If the base frequency is set to other than 200V or 400V, the motor parameters setting are required.

2.2.1. Setting of V/F parameters

Set the Base frequency1 and the Base frequency voltage1.

Title	Communication No.	Function
$u L$	0014	Base frequency 1
$u L u$	0409	Base frequency voltage 1

- In case of $P t$ =0,1(Common), only set the Torque boost value1($u b$).

  Regarding $u b$, please adjust refer to the values in Table 1.1 and Table1.2.
- In case of $P t$ =5(VF-AS1/VF-PS1), 7(VF-S15), set the parameters $F 190 \sim F 199$ for V/F 5-point setting and set $u b.$

  Regarding $u b$, please adjust refer to the values in Table 1.1 and Table1.2.
- In case of $P t$ =2,3(Common), 4(Except for VF-PS1), 5(VF-S15), 7(VF-AS1/VF-PS1), 8(VF-AS1), 9, 10(VF-PS1), proceed to 2.2.2 section.

2.2.2. Perform the Auto-tuning

In case of the following V/F control mode selection (pt), Auto-tuning is required.

Please perform the Auto-tuning according to the next page procedure.

VF-AS1

  Automatic torque boost ($P t$ =2), Sensorless vector control1 ($P t$ =3), Sensorless vector control2 ($P t$ =4),
  PG feedback control ($P t$ =7), PG feedback vector control ($P t$ =8)

VF-PS1

  Automatic torque boost ($P t$ =2), Sensorless vector control1 ($P t$ =3), PG feedback control ($P t$ =7),
  Energy-saving ($P t$ =9), Advanced energy-saving ($P t$ =10)

VF-S15

  Automatic torque boost control ($P t$ =2), Vector control ($P t$ =3), Energy-saving ($P t$ =4),
  Dynamic energy-saving ($P t$ =5)

VF-FS1

Automatic torque boost control (Pt =2), Vector control (Pt =3), Advanced energy-saving (Pt =4)

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VF-nC3

Automatic torque boost control (Pt =2), Vector control (Pt =3), Advanced energy-saving (Pt =4)

Procedure1. Setting of motor prameters

    (1) Set the Base frequency of motor to υL (Base frequency1).

    (2) Set the Base frequency voltage of motor to $\upsilon L \upsilon$ (Base frequency voltage1).

    (3) Set the below motor parameters refer to name plate of motor and test report.

VF-AS1, VF-PS1

Title	Communication No.	Function
F405	0405	Motor rated capacity
F406	0406	Motor rated current
F407	0407	Motor rated rotational speed

VF-S15, VF-FS1, VF-nC3

Title	Communication No.	Function
F405	0405	Motor rated capacity
F415	0415	Motor rated current
F417	0417	Motor rated speed

Procedure2. Connect the motor and perform the Auto-tuning

    (1) Set 4 to F400 (Auto-tuning).

        Some of the parameters will be calculated automatically. (VF-AS1, VF-PS1, VF-S15 only)

    (2) Set 2 to F400 (Auto-tuning).

        After setting, some of the parameters will be tuned to match the motor at the first operation.

If the Auto-tunig error (Etn、$Etn\ 1{\sim}3$) occurs at Auto-tuning, please refer to the countermeasure of the instruction manual of each models.

2.3.   Toshiba IE3 motor parameter adaptation inverter

The default setting values of motor parameters of "VF-AS1/PS1/S15/nC3" have been changed to IE3 motors from traditional IE1 motors.

Adaptation schedule is below.

VF-S15 and VF-nC3: From Oct 2016

VF-AS1 and VF-PS1: From Apr 2017

The relation of the default setting values of motor parameters, applicable motors and the software version of inverter are shown in below table.

Model	Software version	Applicable motor (Default setting value)	Product version (Described in nameplate)
VF-S15	V100 ~ V116	Traditional IE1 motor	(0) ~ (8)
	V120 ~	IE3 motor	(20) ~
VF-nC3	V100 ~ V112	Traditional IE1 motor	(0) ~ (7)
	V120 ~	IE3 motor	(20) ~
VF-AS1	V100 ~ V168	Traditional IE1 motor	(0) ~ (17)
	V170 ~	IE3 motor	(20) ~
VF-PS1	V600 ~ V668	Traditional IE1 motor	(0) ~ (12)
	V670 ~	IE3 motor	(20) ~

3. TROUBLESHOOTING

If you have any problems by setting according to "Procedure for IE3 motor parameters setting" of chapter 2, please refer to this section or the instruction manual of each models.

If the problem is not solved, please contact our distributor.

3.1. Precaution statement

- In case of IE3 motors, Comparerd with the current motor, the slip is reduced and there is a tendency that the rotational speed of motor increases at the same frequency.

  If that becomes a problem, the adjustment of the frequency command and the slip frequency gain are required.

- In case of the primary resitance value is low and the current at the start-up is large compared with the current motor, please reduce the torque boost value or the parameter of the primary resistance.

In addition, please also refer to the website of the Japan Electrical Manufacturers' Association (JEMA).

3.2. Vibration at higher area than near the Base frequency

If the motro vibrates at near the Base frequency or higher area than it, please change the following settings for sutabilization.

3.2.1 VF-nC3, VF-AS1, VF-PS1, VF-S15*

*(In case of the software version of VF-S15 is V112 or V114, proceed to 3.2.2 section)

- For VF-S15, VF-nC3

  Change $F\,458$ (Motor specific coefficient 2) to the recommended value described in Table 3.1.

  If the problem is not solved, reduce $F\,458$ in steps of 5 by range of minimum value described in Table 3.1.

- For VF-AS1, VF-PS1

  Set "1" to $F\,495$, change $F\,458$ (Current control proportional gain) to the recommended value described in Table 3.2.

  If the problem is not solved, reduce $F\,458$ in steps of 5 by range of minimum value described in Table 3.2.

- For VF-FS1

  Adjustment is not required.

Table 3.1　VF-S15 (Software version: V110 or earlier version / V116 or later version) / VF-nC3

Type	$P\,t$	$F\,458$ (Recommended value)	$F\,458$ (Minimum value)	$F\,458$ (Default setting)
VF-S15	0,1,2,7	65	30	0
	3	45	30	0
	4,5	—	—	—
VF-nC3	0,1,2	65	30	0
	3	45	30	0

* "-" in this table, adjustment is not required.

Table 3.2　VF-AS1 / VF-PS1

Type	Pt	Form	$F458$ (Recommended value)	$F458$ (Minimum value)	$F458$ (Default setting)
VFAS1 VFPS1	0,1,5	2110 or less	45	30	0
		2150～2220	65	30	0
		2300～2550	35	30	0
		2750～	—	—	—
		4015 or less	45	30	0
		4022～4037	65	30	0
		4055～4185	45	30	0
		4220～4550	35	30	0
		4750～	—	—	—
	2,3,4, 7,8	2110 or less	65	30	0
		2150～	45	30	0
		4150 or less	65	30	0
		4185～	45	30	0
	9	2110 or less	45	30	0
		2150～	—	—	—
		4150 or less	45	30	0
		4185～	—	—	—
	10	2110 or less	—	—	—
		2150～	—	—	—
		4150 or less	—	—	—
		4185～	—	—	—

* "-" in this table, adjustment is not required.

3.2.2 VF-S15 (Software version: V112 or V114)

- In case of FH≦190Hz

　Change $F458$ (Motor specific coefficient 2) to the recommended value described in Table 3.3.

　(If this value change, Don't set the value other than recommended value)

- In case of FH<190Hz

　Please contact our distributor.

Table 3.3　VF-S15 (Software version: V112 or V114)

Type	Pt	$F458$ (Recommended value)	$F458$ (Default setting)
VFS15	0,1,2,7	52	0
	3	25	0
	4,5	—	—