

**ZEXEL
COMBINATIONS**

Date: 22.09.15
Time: 15:12:59

Product: 104601-3031 9 461 618 827 FUEL-INJECTION PUMP

+ INJECTION-PUMP ASSEMBLY	104701-3031	9 460 611 403	
Manufacturer No.:			
- FUEL-INJECTION PUMP	104601-3031	9 461 618 827	
- NAMEPLATE	148641-0900	9 461 619 108	
- PULSE GENERATOR	479765-1820	9 443 610 413	
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-			
- NOZZLE AND HOLDER ASSY.	105148-1401	9 430 610 435	018144
Nozzle and Holder:	ME201844		
Open Pre:MPa(Kgf/cm2):	14.7{150}		
- NOZZLE-HOLDER	105078-0181	9 430 615 127	
- NOZZLE	105007-1350	9 432 610 478	NP-DN10PDN135

ZEXEL Ass'y No.	104701-3031
Bosch Ass'y No.	9 460 611 403
Bosch Typecode	
Engine Type	4M40TI
Manufacturer	MITSUBISHI
Edition date	28.05.09 (2)

1 Adjustment conditions

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
	Test oil		ISO4113orSAEJ967 d				
		1404 Test oil					
P	Test oil temperature	degC	45	45	50		
	Nozzle		105780-0060				
	Bosch type code		NP-DN0SD1510				
	Nozzle holder		105780-2150				
P	Opening pressure	MPa	13	13	13.3		
P	Opening pressure	kgf/cm2	133	133	136		
	Injection pipe		157805-7320				
P	Injection pipe	mm	2-6-450				
		Inside diameter - outside diameter - length (mm)					
	Joint assembly		157641-4720				
	Tube assembly		157641-4020				
P	Transfer pump pressure	kPa	20	20	20		
P	Transfer pump pressure	kgf/cm2	0.2	0.2	0.2		
	Direction of rotation (viewed from drive side)		R				
		Right					
	Manual controller assembly		105782-8280				
	Manual controller		105782-8270				
	Wire harness		407980-2390				
	Intermediate harness		407980-2400				

2 Adjustment specification**2.1 Compensation resistor, compensation voltage comparison**

Name	Comp. resistor/voltage																																												
	<table border="1"> <thead> <tr> <th rowspan="2">A</th> <th>B</th> <th>C($\Delta U_{\alpha \text{ soll}}$)</th> </tr> <tr> <th>k$\Omega$</th> <th>V</th> </tr> </thead> <tbody> <tr><td>1</td><td>0.18</td><td>0.031</td></tr> <tr><td>2</td><td>0.30</td><td>0.026</td></tr> <tr><td>3</td><td>0.43</td><td>0.020</td></tr> <tr><td>4</td><td>0.62</td><td>0.015</td></tr> <tr><td>5</td><td>0.82</td><td>0.009</td></tr> <tr><td>6</td><td>1.10</td><td>0.004</td></tr> <tr><td>7</td><td>1.50</td><td>-0.002</td></tr> <tr><td>8</td><td>2.00</td><td>-0.008</td></tr> <tr><td>9</td><td>2.70</td><td>-0.014</td></tr> <tr><td>10</td><td>3.90</td><td>-0.019</td></tr> <tr><td>11</td><td>5.60</td><td>-0.025</td></tr> <tr><td>12</td><td>8.20</td><td>-0.030</td></tr> <tr><td>13</td><td>15.00</td><td>-0.036</td></tr> </tbody> </table>	A	B	C($\Delta U_{\alpha \text{ soll}}$)	k Ω	V	1	0.18	0.031	2	0.30	0.026	3	0.43	0.020	4	0.62	0.015	5	0.82	0.009	6	1.10	0.004	7	1.50	-0.002	8	2.00	-0.008	9	2.70	-0.014	10	3.90	-0.019	11	5.60	-0.025	12	8.20	-0.030	13	15.00	-0.036
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	Compensation resistance/compensation voltage comparison A = Compensation resistor number B= Compensation resistance C = Compensation voltage delta U alpha soll																																												

2.2 Pump chamber pressure

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.81	2.81	2.81		
S	Pump chamber pressure	kPa	588.5	559	618		
S	Pump chamber pressure	kgf/cm2	6	5.7	6.3		
P	Basic		*				
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	100	100	100		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		

P	U alpha soll	V	2.81	2.81	2.81		
C	Pump chamber pressure	kPa	294	294			
C	Pump chamber pressure	kgf/cm2	3	3			
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.81	2.81	2.81		
C	Pump chamber pressure	kPa	588	549	627		
C	Pump chamber pressure	kgf/cm2	6	5.6	6.4		
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	2000	2000	2000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.81	2.81	2.81		
C	Pump chamber pressure	kPa	726	677	775		
C	Pump chamber pressure	kgf/cm2	7.4	6.9	7.9		

2.3 Timer stroke

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.81	2.81	2.81		
S	Timer stroke	mm	8.6	8.4	8.8		
P	Basic		*				

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	100	100	100		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.81	2.81	2.81		
C	Timer stroke	mm	3	0.9	5.1		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	350	350	350		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.81	2.81	2.81		
C	Timer stroke	mm	6.3	4.2	8.4		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.81	2.81	2.81		
C	Timer stroke	mm	8.6	8.3	8.9		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	80	80	80		
P	U alpha soll	V	2.81	2.81	2.81		
C	Timer stroke	mm	3.6	2	5.2		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1800	1800	1800		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.81	2.81	2.81		
C	Timer stroke	mm	9.75	9.3	10.2		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	2300	2300	2300		
P	TCV duty (%) F TCV 60Hz	%	0	0	0		
P	U alpha soll	V	2.81	2.81	2.81		
C	Timer stroke	mm	0	0	0		

2.4 TPS output

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	0	0	0		
P	U alpha soll	V	2.81	2.81	2.81		
S	Vtps	V	0.77	0.45	1.09		
P	Basic		*				

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	0	0	0		
P	U alpha soll	V	2.81	2.81	2.81		
C	Vtps	V	0.77	0.45	1.09		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.81	2.81	2.81		
C	Vtps	V	3.704	3.3	4.108		

2.5 Overflow

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.81	2.81	2.81		
C	Overflow quantity	cm3/min	560	430	690		

2.6 Fuel injection quantities

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	U alpha soll + dU alpha soll	V	2.81	2.81	2.81		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
S	Average injection quantity	mm3/st.	83.8	83.3	84.3		
P	Basic		*				

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	375	375	375		
P	U alpha soll + dU alpha soll	V	2.17	2.17	2.17		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
S	Average injection quantity	mm3/st.	20.2	16.7	23.7		
S	Difference in delivery	mm3/st.	2.5		2.5		
P	Basic		*				
	Remarks						

Confirmation of difference in delivery

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	800	800	800		
P	U alpha soll + dU alpha soll	V	2.82	2.82	2.82		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
S	Average injection quantity	mm3/st.	87.6	84.6	90.6		
S	Difference in delivery	mm3/st.	6		6		
P	Basic		*				
	Remarks						

Confirmation of difference in delivery

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	100	100	100		
P	U alpha soll + dU alpha soll	V	3.16	3.16	3.16		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	75	65	85		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	100	100	100		
P	U alpha soll + dU alpha soll	V	2.71	2.71	2.71		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	38.5	28.5	48.5		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	200	200	200		
P	U alpha soll + dU alpha soll	V	2.71	2.71	2.71		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	45.8	39.8	51.8		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	375	375	375		
P	U alpha soll + dU alpha soll	V	2.17	2.17	2.17		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	20.2	16.7	23.7		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	400	400	400		
P	U alpha soll + dU alpha soll	V	2.66	2.66	2.66		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm3/st.	56	53	59		

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	500	500	500		
P	U alpha soll + dU alpha soll	V	2.67	2.67	2.67		

P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm ³ /st.	64.9	61.9	67.9		
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	750	750	750		
P	U alpha soll + dU alpha soll	V	2.6	2.6	2.6		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm ³ /st.	67.9	64.9	70.9		
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	800	800	800		
P	U alpha soll + dU alpha soll	V	2.82	2.82	2.82		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm ³ /st.	87.6	84.6	90.6		
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	U alpha soll + dU alpha soll	V	2.81	2.81	2.81		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm ³ /st.	83.8	82.8	84.8		
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1500	1500	1500		
P	U alpha soll + dU alpha soll	V	2.87	2.87	2.87		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm ³ /st.	89.3	86.3	92.3		
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1800	1800	1800		
P	U alpha soll + dU alpha soll	V	2.76	2.76	2.76		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm ³ /st.	80.5	77.5	83.5		
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	2000	2000	2000		
P	U alpha soll + dU alpha soll	V	2.72	2.72	2.72		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm ³ /st.	76.1	73.1	79.1		
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	2475	2475	2475		
P	U alpha soll + dU alpha soll	V	1.72	1.72	1.72		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	mm ³ /st.	25	22	28		

2.7 Magnet valve OFF

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	2000	2000	2000		
P	U alpha soll + dU alpha soll	V	2.72	2.72	2.72		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
C	Average injection quantity	cm ³ /min	0	0	0		

2.8 Confirming NP sensor output

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	200	200	200		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.81	2.81	2.81		
C	Speed output	r/min	N+8				
		N=Measure the actual speed.					

2.9 Checking fuel temperature sensor

CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
P	Pump speed	r/min	1000	1000	1000		
P	TCV duty (%) F TCV 60Hz	%	100	100	100		
P	U alpha soll	V	2.81	2.81	2.81		
C	Temperature output	degC	T+5				
		Measure T = actual output temperature					

2.10 Magnet

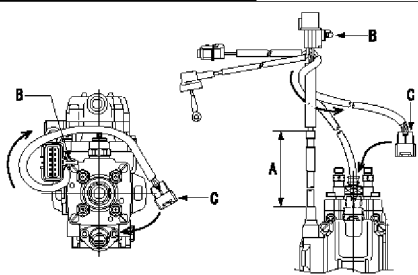
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
C	Max. applied voltage	V	8	8	8		
P	Test voltage	V	13	12	14		

3 Assembly dimension

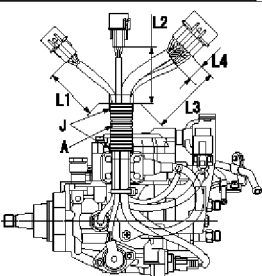
CAT	Designation	Unit	Set value	min.	max.	Actual values	OT
S	K dimension	mm	3.3	3.2	3.4		
S	KF dimension	mm	5.62	5.52	5.72		
S	Pre-stroke	mm	0.1	0.08	0.12		

4 Attachments' specification

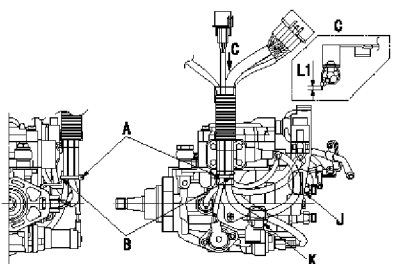
4.1 Attachment specification 1

Name	HARNESS & CONNECTOR
	
	<p>TCV connector assembly specification</p> <p>(1)Ensure the GE cable is not twisted at section A.</p> <p>(2)Refer to the figure for the direction of connector clip B.</p> <p>(3)Route the TCV harness in the direction indicated by the arrows in the figure and install the connector C.</p>

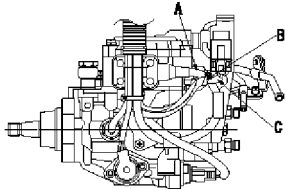
4.2 Attachment specification 2

Name	HARNESS & CONNECTOR
<p>L1=90+-10mm</p> <p>L2=80+-10mm</p> <p>L3=110+-10mm</p> <p>L4=Max.15mm</p>	
	<p>Corrugated tube assembly specification</p> <p>(1)Position the connector as shown in the figure, and maintain the dimensions shown in the figure for the end of the connector and the end of the corrugated tube.</p> <p>(2)Wrap black vinyl tape 4 times around the end of the corrugated tube to fix the tube.</p> <p>A:Corrugated tube</p> <p>J:PVC tape</p> <p>L4:Dimension from protective tube to end face of connector</p>

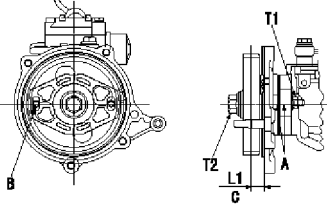
4.3 Attachment specification 3

Name	HARNESS & CONNECTOR
L1=Max.2mm	
	<p>Clip assembly standards (harness fixing)</p> <p>(1)Fix all the harnesses (GE cable, TCV, FCV, TPS, P/U, Q adjustment) using the clip.</p> <p>(2)Fix the clip at the bracket's cutout position.</p> <p>(3)Fix the GE cable where it contacts the bracket at J and K.</p> <p>(4)After clipping, cut off excess clip at L1 or less.</p> <p>A:Binder</p> <p>B:Fix at bracket cutout position.</p> <p>C:Figure shown by arrow</p>

4.4 Attachment specification 4

Name	HARNESS & CONNECTOR
	
	<p>Q adjustment resistor harness fixing specifications (1)After completing all procedures, fix the Q adjustment resistor harness together with the GE cable using clips. A:G.E. cable B:Binder C:Q adjustment resistor harness</p>

4.5 Attachment specification 5

Name	HARNESS & CONNECTOR
<p>L1=16.3mm T1=10~15N-m(1~1.5kgf-m) T2=59~69N-m(6~7kgf-m)</p>	
	<p>Timing gear assembly standard A:Align the timing mark (aligning mark) by eye. B:When there is no mark for the gear installation position, align with the center of the pump's elongated hole. C:Gear tooth's standard position</p>