2018 DIESEL ECM CONNECTION SYSTEM MULTI-CAVITY TOOL PRODUCT VALIDATION REPORT

INCLUDES SECONDARY SECTION FOR QUALIFICATION OF GENERATION Y ISL CLEARANCE IMPROVEMENT AND LEVER IMPROVEMENT FOR CIRCUIT INSERTION CLEARANCE

REFERENCE SPECIFICATIONS:
GMW3191 June 2012
GMW 3172 November 2012
Connector CTS, Revision 02, May 28, 2014
Directives from Gregory Fleck, GM Staff Project Engineer

502-32071

Revsion and Approval History

REL	REASON	DATE	APPROVAL SIGNITURE/DATE
A	Initial Release	03/06/19	Atiq Islam 03/07/2019
B	Added test results data for ISL and Lever Changes per agreed test plan *2018 Diesel ECM Connection System Test Flow Lever_ISL 9-14-18_Signed_AI.pdf*	03/22/19	

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PURPOSE

The purpose of this Product Validation Report is to document performance of TE Connectivity's multi-cavity 90P and 112P Female Connector Assemblies (production-tool versions) for the 2018 Diesel ECM Connection System. The governing documents from which performance criteria are derived are: (1) GMW3191 June 2012, (2) GMW 3172 November 2012, (3) Connector CTS, Revision 02, May 28, 2014 and (4) Directives from Gregory Fleck, GM Staff Project Engineer. Prior to initiating testing, agreed upon test sequences were documented and approved via test flow matrix:
multi_cavity_pv_ECM NA_EMEA Test Matirx_Sealing_Pressure_Decay_Continuity_ Dry_Circuit_signed_Islam_fleck.pdf, approved on 6-11-2018.

There are two sections to this performance report. The first section includes qualification results of the system to the entirety of the flows as described by the governing documents listed above, and the performance summarized in the second section, represents a mechanical subset validation of ISL and lever improvements. The ISL improvements are intended to address clearance concerns identified in pre-production builds; these ISL improvements are solely related to the Generation Y contact cavity. The lever improvements are to allow more ergo clearance for terminal insertion. Prior to initiating testing, agreed upon test sequences were documented and approved via test flow matrix:
2018 Diesel ECM Connection System Test Flow Lever_ISL 9-14-18_Signed_AI.pdf

Full qualification results are documented on pages 1 -40. The mechanical subset qualification for the Generation Y ISL clearance and lever change begins on page 41.

Applicable Components Part Number Table

APPLICABLE COMPONENTS TABLE			
TE P/N	**GM P/N**	**Description**	**MFG**
2310326-2	12698061	Wire Harness Connector Assy, 112CKT	TE
2310318-1	12698059	Wire Harness Connector Assy, 90CKT	TE
2310337-1	12698063	Dress Cover Assy, 90CKT and 112CKT	TE
2298920-1	N/A	Controller Connector Assy, 112CKT	TE-EMEA
2298911-1	N/A	Controller Connector Assy, 90CKT	TE-EMEA
1-2138699-4	12679508	0.64mm G-Y Receptacle Terminal, 0.35mm^2 wire size	TE
1-2138699-1	12679509	0.64mm G-Y Receptacle Terminal, 0.5mm^2 wire size	TE
1-2138699-2	12679510	0.64mm G-Y Receptacle Terminal, 0.75mm^2 wire size	TE
1670144-3	12675510	1.2 MCON Receptacle Terminal, 0.75mm^2 wire size	TE
1452503-3	12675511	1.2 MCON Receptacle Terminal, 1.5mm^2 wire size	TE
1-968855-3	12675513	2.8mm MCP Receptacle Terminal, 0.5mm^2 wire size	TE
1-968857-3	12675514	2.8mm MCP Receptacle Terminal, 2.5mm^2 wire size	TE
1241412-3	12675515	6.3mm Receptacle Terminal, 0.5mm^2 wire size	TE
1-1241418-3	12675516	6.3mm Receptacle Terminal, 6.0mm^2 wire size	TE
828904-1	12675517	Single Wire Seal	TE
828905-1	12675518	Single Wire Seal	TE
2177018-1	12675519	Single Wire Seal	TE
1719043-1	12675520	Single Wire Seal	TE

Environmental – Sealing

Sequence 1 Group 1 - GMW3191: Environmental Sealing

Description of Testing:

During Sequence 1, Group 1, the product under test was subjected to the sequence of environments as defined by GMW3191. Applied environments were: Thermal Aging, Thermal Shock, Humid Heat Cyclic, High Pressure Spray and Submersion.

Environmental Classification:

Applied Temperature = -40°C to 125°C

Description of Samples Tested:

10x 90P ECM Female Connector Assembly mated to 90P Denso Controller Header
- 3x Fully Loaded Max Wire
- 4x Fully Loaded Min Wire
- 3x Fully Loaded Mixture of Min and Max

10x 112P ECM Female Connector Assembly mated to 112P Denso Controller Header
- 3x Fully Loaded Max Wire
- 4x Fully Loaded Min Wire
- 3x Fully Loaded Mixture of Min and Max

Acceptance Criteria:

Pre-Environment Pressure =	7 PSI Min
Pre-Environment Vacuum =	7 PSI Min
Post-Environment Pressure =	4 PSI Min
Post-Environment Vacuum =	4 PSI Min
Isolation Resistance =	100 Mohms at 500VDC
Post-Sequence Dielectric Strength=	No Breakdown or Flashover

Results Summary:

*Note: All female connectors (90P and 112P) passed +/- 7 PSI testing prior to start of testing; all connectors also passed +/- 4 PSI after each environment. The values documented in the data below is simply Isolation Resistance.

EWA90649, **Sequence 1 - Group 1, 90P**

Sample Number	Resistance at 500 Vdc (GΩ)											
	Initial	After Pressure/Vacuum +/- 7 psig	After Thermal Aging	After Thermal Shock	After Humid Heat Cyclic	After Water Spray	Cycle 1 Water Submersion	Cycle 2 Water Submersion	Cycle 3 Water Submersion	Cycle 4 Water Submersion	Cycle 5 Water Submersion	After Pressure/Vacuum (after Submersion)
Min-1	34.78	>60	>60	25.32	16.47	4.38	>60	>60	>60	47.62	>60	>60
Min-2	>60	>60	>60	46.11	17.89	6.67	>60	>60	>60	>60	>60	>60
Min-3	>60	34.78	>60	27.64	18	2.7	>60	>60	>60	>60	>60	>60
Min3-1	>60	>60	>60	23.95	15.71	30.05	>60	>60	>60	>60	>60	>60
Mid-1	>60	>60	>60	>60	16.21	4.83	>60	>60	>60	>60	>60	>60
Mid-2	>60	>60	25.37	50.75	17.2	28.66	>60	>60	>60	>60	>60	>60
Mid-3	>60	>60	>60	30.59	17.49	26.69	>60	>60	>60	>60	>60	>60
Max-1	20.78	>60	>60	28.34	18.43	42.41	>60	>60	>60	>60	>60	>60
Max-2	35.18	55.28	>60	20.1	17.79	14.6	>60	>60	>60	>60	>60	>60
Max-3	30.35	>60	>60	19.23	19.84	5.53	>60	>60	>60	>60	>60	>60

EWA090650P, **Sequence 1 - Group 1, 112P**

Sample Number	Resistance at 500 Vdc (GΩ)											
	Initial	After Pressure/Vacuum +/- 7 psig	After Thermal Aging	After Thermal Shock	After Humid Heat Cyclic	After Water Spray	Cycle 1 Water Submersion	Cycle 2 Water Submersion	Cycle 3 Water Submersion	Cycle 4 Water Submersion	Cycle 5 Water Submersion	After Pressure/Vacuum (after Submersion)
Min-1	34.78	>60	48.37	>60	14.67	>60	>60	>60	>60	47.62	>60	>60
Min-2	39.69	>60	>60	56.28	18	36.85	>60	>60	>60	>60	>60	>60
Min-3	34.4	>60	>60	30.96	11.38	9.52	25.69	>60	>60	>60	>60	>60
Min-4	>60	>60	28.66	>60	11.82	43.6	>60	>60	31.27	>60	>60	>60
Mid-1	54.31	36	>60	>60	16.47	55.28	30.35	>60	>60	>60	>60	>60
Mid-2	31.91	>60	>60	44.22	15.32	30.96	>60	48.37	>60	>60	>60	>60
Mid-3	43.6	>60	>60	>60	16.21	36.85	>60	>60	>60	>60	>60	>60
Max-1	>60	>60	>60	>60	14.53	30.96	>60	>60	>60	>60	>60	>60
Max-2	>60	>60	>60	>60	16.55	14.1	>60	>60	>60	>60	>60	>60
Max-3	>60	>60	>60	44.86	17.2	5.51	>60	>60	>60	>60	>60	>60

Results Comments:

Pass

Sequence 1 Group 3 - GMW3191: Environmental Sealing 3

Description of Testing:

During Sequence 1, Group 3, the product under test was subjected to the fluids as specified in GMW3191. General fluid descriptions to which test parts were subjected were: Brake Fluid, Motor Oil, Gasoline, Engine Coolant, Automatic Transmission Fluid, Windshield Washer Solvent, Power Steering Fluid, Diesel Fluid, E85 Ethanol Fluid.

Environmental Classification:

Applied Temperature = As specified in GMW3191, Table 24

Description of Samples Tested:

18x 90P ECM Female Connector Assembly mated to 90P Denso Controller Header
2x per Applied Fluid
18x 112P ECM Female Connector Assembly mated to 112P Denso Controller Header
2x per Applied Fluid

Acceptance Criteria:

There shall be no visible degradation, swelling, cracking, or loss of mechanical function evident on any test sample when examined under 10× to 40× magnification.

Results Comments:

Pass

Connector Mechanical Tests

Sequence 2 Group 1 - GMW3191: Terminal to Connector Engagement Force

Description of Testing:

During Sequence 2, Group 1, terminal to connector insertion forces were measured. Prior to testing, the conditioning sequence per GMW3191, section 3.3 was applied to plastic components.

Description of Samples Tested:

90P ECM Female Connector Assembly
- Generation Y 0.64mm Female Receptacle
- MCP 2.8mm Female Receptacle
- MCP 6.3mm Female Receptacle

112P ECM Female Connector Assembly
- Generation Y 0.64mm Female Receptacle
- MCON 1.2mm Female Receptacle

Acceptance Criteria:

Generation Y 0.64mm Maximum Insertion =	15N Min
MCON 1.2mm Maximum Insertion =	15N Min (<1.0mm^2 wire)
	30N Max (>1.0mm^2 wire)
MCP 2.8mm Maximum Insertion =	15N Min (<1.0mm^2 wire)
	30N Max (>1.0mm^2 wire)
MCP 6.3mm Maximum Insertion =	15N Min (<1.0mm^2 wire)
	30N Max (>1.0mm^2 wire)

Results Summary:

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Terminal Engagement Force - ISL in open Position	Wire size < 1.0 mm², Force < 15N	GMW 3191 Para. 4.2.4.4.1	[-]	[-]
	0.64mm(0.75mm²)		MIN=4.5N MAX=9.3N AVG=6.25N STD DEV=1.19	MIN=4.72N MAX=10.6N AVG=6.14N STD DEV=1.24
	0.64mm(0.35mm²)		MIN=2.69N MAX=7.51N AVG=4.94N STD DEV=1.54	MIN=2.45N MAX=4.98N AVG=3.08N STD DEV=0,489
	1.2mm(0.75mm²)		N/A	MIN=3,3N MAX=4,2N AVG=3,9N STD DEV=0,28
	2.8mm(0.5mm²)		MIN=1,8N MAX=2,8N AVG=2,3N STD DEV=0,3	N/A
	6.3mm (0,5mm²)		MIN=7,3N MAX=10,1N AVG=8,1N STD DEV=0,9	N/A
	Wire size ≥ 1.0 mm², Force < 30N		[-]	[-]
	1.2mm(1.5mm²)		N/A	MIN=7,0N MAX=25,8N AVG=13,9N STD DEV=7,0
	2.8mm(2.5mm²)		MIN=5,2N MAX=6,6N AVG=5,9N STD DEV=0,4	N/A
	6.3mm (6.0mm²)		MIN=10,2N MAX=26,6N AVG=18,7N STD DEV=5,2	N/A
	Forward Stop ≥ 25N		PASS	PASS

Results Comments:

Pass

Sequence 2 Group 2 - GMW3191: Connector to Connector Engagement Force

Description of Testing:

During Sequence 2, Group 2, connection system engagement (force to move lever to locked position) and unlocked disengagement (force to move lever from locked position) forces were measured. Prior to testing, the conditioning sequence per GMW3191, section 3.3 was applied to plastic components. Connector engagement force testing was conducted using a Instron Test Machine and Mark 10 hand-held force gauge.

Description of Samples Tested:

90P ECM Female Connector Assembly
Loading Configuration: Fully Loaded
112P ECM Female Connector Assembly
Loading Configuration: Fully Loaded

Acceptance Criteria:

90P ECM Female Connector Assembly
Engagement Force = 75N Maximum
Disengagement Force = 75N Maximum
112P ECM Female Connector Assembly
Engagement Force = 75N Maximum
Disengagement Force = 75N Maximum

Results Summary: Instron Testing

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Force to move lever to locked position TEST PERFORMED WITH INSTRON MACHINE AT 50mm/min, All terminal locations populated.	75N Max.	GMW3191 Para 4.2.8	MIN= 49.3N MAX= 63.9N AVG= 54.0N STD DEV= 4.77	MIN= 52.2N MAX= 66.4N AVG= 56.6N STD DEV= 3.95

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Force to move lever from locked position	75N Max.	GMW3191 Para 4.2.8	MIN- 25.1 N MAX- 35.1 N AVG- 29.6 N STD DEV=3.12	MIN- 46.72 N MAX- 51.8 N AVG- 48.7 N STD DEV=2.0

Results Comments:

Pass

Description of Samples Tested: Mark-10 Manual Gage Testing

90P ECM Female Connector Assembly
Loading Configuration: Fully Loaded
112P ECM Female Connector Assembly
Loading Configuration: Fully Loaded

Acceptance Criteria:

90P ECM Female Connector Assembly
Engagement Force = 75N Maximum

112P ECM Female Connector Assembly
Engagement Force = 75N Maximum

Results Summary:

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Force to move lever to locked position TEST PERFORMED WITH MARK-10 MANUAL MEASUREMENT GAGE. All terminal locations populated.	75N Max.	GMPT DRE	MIN= 58.5N MAX= 93.8N AVG= 73.1N STD DEV= 10.16	MIN= 58.9N MAX= 78.6N AVG= 70.7N STD DEV= 7.28

Results Comments:

Getting consistent data with hand held gage is problematic. Test speed and angle of force application to push surface is difficult to control. Sizable variance and non-repeatability of results is possible. Not a standard GMW or USCAR test.

Description of Samples Tested:

90P ECM Female Connector Assembly
Loading Configuration: per LM2 Loading
112P ECM Female Connector Assembly
Loading Configuration: per LM2 Loading

Acceptance Criteria:

90P ECM Female Connector Assembly
Engagement Force = 75N Maximum

112P ECM Female Connector Assembly
Engagement Force = 75N Maximum

Results Summary: Mark-10 Manual Gage Testing

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Force to move lever to locked position (TEST PERFORMED WITH MANUAL MEASUREMENT GAGE FROM SHIPPING POSITION; LM2 Circuit Loading	75N Max.	GMW3191 Para 4.2.8	MIN- 38.3 N MAX- 51.4N AVG- 44.86 N STD DEV=4.52	MIN- 42.7 N MAX- 48.8N AVG- 45.46 N STD DEV=2.00

Results Comments:

Pass

Sequence 2 Group 3 - GMW3191: Connector to Connector Disengagement Force

Description of Testing:

During Sequence 2, Group 3, connection system locked disengagement (forces to defeat primary locking mechanism) forces were measured. Prior to testing, the conditioning sequence per GMW3191, section 3.3 was applied to plastic components.

Description of Samples Tested:

90P ECM Female Connector Assembly
Loading Configuration: Fully Loaded
112P ECM Female Connector Assembly
Loading Configuration: Fully Loading

Acceptance Criteria:

90P ECM Female Connector Assembly
Locked Connector Disengagement Force = 120 N Min
112P ECM Female Connector Assembly
Locked Connector Disengagement Force = 80 N Min

Results Summary:

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Force to defeat primarly locking mechanism.	Terminal size ≤1.2mm - 80N Terminal size > 1.2mm -120N	GMW3191 Para. 4.2.18.4	MIN= 366 N MAX= 430 N AVG= 409 STD DEV=17,8	MIN= 369 N MAX= 428 N AVG= 400 N STD DEV=18,8

Results Comments:

Pass

Sequence 2 Group 4 - GMW3191: Connector Mechanical Tests

Description of Testing:

During Sequence 2, Group 4, various mechanical aspects of the female connection were measured. Prior to testing, the conditioning sequence per GMW3191, section 3.3 was applied to plastic components. A hand-gauge was used to conduct the testing for the force to engage connector to pre-stage position and the CPA pre-stage to lock position testing.

Description of Samples Tested:

90P ECM Female Connector Assembly
112P ECM Female Connector Assembly

Acceptance Criteria:

Connector Polarization =	220N and No Electrical Contact
Terminal Position Assurance	
Pre-Lock to Lock w/out Terminals =	20 – 45 N
Pre-Lock to Lock w/ Terminals =	20 – 45 N
Pre-Lock to Lock w/ One Incorrect Term =	60N Min
Locked to Pre-Lock =	20 – 45 N
Retention of Slide/Lever in open Position =	150 N Min
Lever and Slide Force Strength	(Various – See Results Summary)
CPA	
Pre-Lock to Lock on Mated Connector =	22 N Min
Lock to Pre-Lock on Mated Connector =	10 – 30 N
CPA Closing Force on Unmated Conn. =	80 N Min
Extraction Force from Connector =	60 N Min

Results Summary:

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Polarization Effectiveness at 90°, 180°, 270°	220N with no continuity	GMW3191 Para. 4.2.20.4	test passed	test passed

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
ISL Pre Lock to Locked Position Force without Terminals	Protected ISL: 20N Min. / 45N Max.	GMW3191 Para. 4.2.9.4.1	New ISL Rev. is awaited. Test-repeat will be performed asap	New ISL Rev. is awaited. Test-repeat will be performed asap
ISL Pre Lock to ISL Removal from Connector Force	20N Min.	GMW3191 Para. 4.2.9.4.1	test passed	test passed
ISL Pre-Lock to Locked Force with Properly Assembled Terminals	Protected ISL: 20N Min. / 45N Max.	GMW3191 Para. 4.2.9.4.2	Side A MIN = 21.2N MAX = 24.4N AVG = 23.1N STD DEV = 1.03 Side B MIN = 20.2N MAX = 25.0N AVG = 22.4N STD DEV = 1.81	Side A MIN = 23.4N MAX = 29.7N AVG = 27.9N STD DEV = 2.0 Side B MIN = 21.3N MAX = 31.0N AVG = 26.2N STD DEV = 2.83
ISL Pre-Lock to Locked Force with One Improperly Assembled Terminal	60N, or 2X the measured value of Pre-lock to Lock Force	GMW3191 Para. 4.2.9.4.3	F≥62N	F≥62N
ISL Locked to Pre-Lock Position Force	Protected ISL: 20N Min. / 45N Max.	GMW3191 Para. 4.2.9.4.4	Side A MIN = 21.7N MAX = 25.8N AVG = 24.6N STD DEV = 1.19 Side B MIN = 21.7N MAX = 25.9N AVG = 24.4N STD DEV = 1.33	Side A MIN = 21.2N MAX = 30.5N AVG = 26.5N STD DEV = 3.26 Side B MIN = 20.6N MAX = 27.8N AVG = 23.9N STD DEV = 2.13

Results Summary (continued)

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Force to Disengage Primary Lock	70N Max	GMW3191 Para. 4.2.19.4	MIN= 34,4 N MAX= 43,2 N AVG= 40,1 N STD DEV=2,77	MIN= 24,9 N MAX= 32,7 N AVG= 28,8 N STD DEV=2,03
Lever/Slide Retention - Open Position	Withstands 50N without separation or damage.	GMW3191 Para. 4.2.10.4	test passed >50N	test passed >50N
Slide Load on Lever (Open and Closed Position)	Withstands 100N in one direction then withstands 100N in opposite direction.	GMW3191 Para. 4.2.11.4	MIN= 103,0 N MAX= 103,0 N AVG= 103,0 N STD DEV=0,0	
Side Load on Lever (Half Closed)	Withstands 60N in one direction then withstands 60N in opposite direction.	GMW3191 Para. 4.2.11.4	MIN= 63,0 N MAX= 63,0 N AVG= 62,9 N STD DEV=0,0295	
Lever/Slide Retention - Pre-lock Position to Closed Position	Withstands 150N without inadvertent closure.	GMW3191 Para. 4.2.10.4	MIN = 145N MAX = 163N AVG = 151.6N STD DEV=6,25	MIN = 142N MAX = 152N AVG = 147,8N STD DEV=3,6

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
CPA Unlock Force (Mated)	Lock to Pre-lock Force: 10N to 30N.	GMW3191 Para. 4.2.15.4.1	MAX= 15,5 N AVG= 13,9 N STD DEV=1,38	MAX= 16,1 N AVG= 13,8 N STD DEV=1,35
CPA pre-stage to lock force (Mated) TEST PERFORMED WITH MANUAL MEASUREMENT GAGE	CPA pre-stage to lock force shall be 22 N maximum..	GMW3191 Para. 4.2.15.4.1	MIN= 13.9 N MAX= 17.2 N AVG= 15.48 N STD DEV=1.05	MIN= 13.8 N MAX= 15.8 N AVG= 14.7 N STD DEV=0.72
CPA Pre-lock to Lock (Unmated)	80N Min.	GMW3191 Para. 4.2.15.4.2	MIN= 191 N MAX= 207 N AVG= 200 N STD DEV=5,2	
CPA Extraction Force	60N Min.	GMW3191 Para. 4.2.15.4.3	MIN= 123 N MAX= 162 N AVG= 149 N STD DEV=10,4	

Results Comments:

All Pass except Lever/Slide Retention Pre-lock Position to Closed Position - Exception requested to GM on supplier exception no. TE18DCS-008. Requested value is 127N min at mean-3Sigma.

Sequence 2 Group 5 - Additional Test, Pre-stage Retention Test

Description of Testing:

During Sequence 2, Group 5, various additional tests included in CTS and/or as directives from the GM ECM Female Connector Staff Project Engineer were measured.

Description of Samples Tested:

3x 90P ECM Female Connector Assembly
3x 112P ECM Female Connector Assembly

Acceptance Criteria:

Pre-Stage Retention Test (Hanging) = Retain to header in pre-stage position while inverted.

Results Summary:

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Pre-Stage Retention Test (Hanging Test)	Retain to header in pre-stage position in inverted position with 1 meter of harness	GPT DRE	test passed	test passed

Results Comments:

Pass

Connector Electrical Tests

Sequence 3 Group 1 - GMW3191: Connector Electrical 1

Description of Testing:

During Sequence 3, Group 1, the product under test was subjected to the sequence of environments as defined by GMW3191. Applied environments were: Mechanical Shock and CTS Vibration Profile w/ Thermal Cycling.

Environmental Classification:

Applied Temperature = -40°C to 125°C

Description of Samples Tested:

10x 90P ECM Female Connector Assembly mated to 90P Denso Controller Header
10x Fully Loaded Max Wire
10x 112P ECM Female Connector Assembly mated to 112P Denso Controller Header
10x Fully Loaded Max Wire

Acceptance Criteria:

Dry Circuit Resistance (Pre and Post Testing)

Generation Y 0.64mm =	15 mΩ Max
MCON 1.2mm =	8 mΩ Max
MCP 2.8mm =	5 mΩ Max
MCP 6.3mm =	1.5 mΩ Max

Results Summary:

TEST	CRITERIA	SPECIFICATION	Post DCR [mΩ] 90P	Post DCR [mΩ] 112P
Sequence 3-1				
Mechanical Shock	15.0mΩ max for 0.64mm Terminal Size (0.75mm^2)		MIN=3.64 MAX=4.86 AVG=4.22 STDV=0.28	MIN=3.73 MAX=4.78 AVG=4.26 STDV=0.19
	8 mΩ max for 1.2mm Terminal Size (1.5mm2)		N/A	MIN=2.30 MAX=7.26 AVG=4.58 STDV=1.13
	5.0mΩ max for 2.8mm Terminal Size (2.5mm^2)		MIN=0.84 MAX=1.24 AVG=1.03 STDV=0.10	N/A
	1.5 mΩ max for 6.3mm Terminal Size (6.0mm^2)		MIN= 0.35 MAX = 0.52 AVG = 0.41 STDV = 0.06	N/A
Vibration with Temperature Cycles	15.0mΩ max for 0.64mm Terminal Size(0.75mm^2)		MIN=3.66 MAX=4.40 AVG=4.01 STDV=0.15	MIN=3.67 MAX=4.25 AVG=3.67 STDV=0.13
	8 mΩ max for 1.2mm Terminal Size(1.5mm2)		N/A	MIN=2.63 MAX=6.98 AVG=4.91 STDV=1.01
	5.0mΩ max for 2.8mm Terminal Size (2.5mm^2)		MIN=0.81 MAX=1.32 AVG=0.98 STDV=0.12	N/A
	1.5 mΩ max for 6.3mm Terminal Size (6.0mm^2)		MIN= 0.35 MAX = 0.66 AVG = 0.42 STDV = 0.09	N/A

Results Comments:

Pass

Sequence 3 Group 2 - GMW3191: Connector Electrical 2

Description of Testing:

During Sequence 3, Group 2, the product under test was subjected to the sequence of environments as defined by GMW3191. Applied environments were: Thermal Aging, Thermal Shock, and Humid Heat Cyclic.

Environmental Classification:

Applied Temperature = -40°C to 125°C

Description of Samples Tested:

10x 90P ECM Female Connector Assembly mated to 90P Denso Controller Header
10x Fully Loaded Max Wire
10x 112P ECM Female Connector Assembly mated to 112P Denso Controller Header
10x Fully Loaded Max Wire

Acceptance Criteria:

Dry Circuit Resistance (Pre and Post Testing)

Generation Y 0.64mm =	15 mΩ Max
MCON 1.2mm =	8 mΩ Max
MCP 2.8mm =	5 mΩ Max
MCP 6.3mm =	1.5 mΩ Max

Results Summary:

TEST	CRITERIA	SPECIFICATION	Post DCR [mΩ] 90P	Post DCR [mΩ] 112P
Sequence 3-2				
Thermal Aging	15.0mΩ max for 0.64mm Terminal Size		MIN=3.5 MAX=4.5 AVG=3.7 STDV=0.23	MIN=3.5 MAX=4.3 AVG=3.85 STDV=0.20
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN=1.4 MAX=2.5 AVG=1.8 STDV=0.30
	5.0mΩ max for 2.8mm Terminal Size		MIN=.8 MAX=.9 AVG=.85 STDV=0.04	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN=.4 MAX=.4 AVG=.4 STDV=0.0	N/A
Thermal Shock	15.0mΩ max for 0.64mm Terminal Size		MIN=3.4 MAX=4.2 AVG=3.6 STDV=0.19	MIN=3.5 MAX=4.1 AVG=3.75 STDV=0.18
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN=1.6 MAX=2.5 AVG=1.9 STDV=0.28
	5.0mΩ max for 2.8mm Terminal Size		MIN=0.7 MAX=.9 AVG=.8 STDV=0.06	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN=.3 MAX=.4 AVG=.35 STDV=0.05	N/A
HHC	15.0mΩ max for 0.64mm Terminal Size		MIN=3.2 MAX=3.9 AVG=3.5 STDV=0.16	MIN=3.5 MAX=4.1 AVG=3.75 STDV=0.18
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN=3.4 MAX=4.3 AVG=3.70 STDV=0.19
	5.0mΩ max for 2.8mm Terminal Size		MIN=.7 MAX=.9 AVG=.8 STDV=0.06	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN=.3 MAX=.4 AVG=.35 STDV=0.05	N/A

Results Comments:

Pass

Connector Mechanical Tests – Terminal Extraction

Sequence 4 Group 1 - GMW3191: Terminal from Connector Extraction – Primary Only

Description of Testing:

During Sequence 4, Group 1, terminal extraction from the female connector was measured. Testing included the connector primary lock only.

Description of Samples Tested:

90P ECM Female Connector Assembly
112P ECM Female Connector Assembly

Acceptance Criteria:

Terminal from Connector, Primary Lock

Generation Y 0.64mm =	30 N Min
MCON 1.2mm =	50 N Min
MCP 2.8mm =	60 N Min
MCP 6.3mm =	90 N Min

Results Summary:

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Terminal Extraction Force (Primary Lock Only)	Terminal Size = .64mm, Force ≥ 30N	GMW3191 Para. 4.2.5.4	MIN=32.9 N MAX=43.4N AVG=38.9N STD DEV=2.29	MIN=32.4 N MAX=46.6 N AVG=38.9 N STD DEV=2.23
	Terminal Size ≤ 1.5mm, Force ≥ 50N		N/A	MIN- 86.8 N MAX- 102 N AVG- 91.8 N
	Terminal Size ≤ 2.8mm, Force ≥ 60N		MIN- 103 N MAX- 137 N AVG- 116 N	N/A
	Terminal Size ≤ 6.3mm, Force ≥ 90N		MIN- 228 N MAX- 279 N AVG- 249 N	N/A

Results Comments:

Pass

Sequence 4 Group 2 - GMW3191: Terminal from Connector Extraction – Primary and Secondary

Description of Testing:

During Sequence 4, Group 2, terminal extraction from the female connection was measured. Testing performance included virgin, unconditioned connectors.

Description of Samples Tested:

90P ECM Female Connector Assembly
112P ECM Female Connector Assembly

Acceptance Criteria:

Terminal from Connector, Primary & Secondary (Virgin, Unmoisturized)

Generation Y 0.64mm =	60 N Min
MCON 1.2mm =	80 N Min
MCP 2.8mm =	100 N Min
MCP 6.3mm =	120 N Min

Results Summary:

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Terminal Extraction Force (Primary & Secondary Locks)	Terminal Size = .64mm, Force ≥ 60N	GMW3191 Para. 4.2.5.4	MIN- 148 N MAX- 189 N AVG- 168 N STD DEV=7,9	MIN- 150 N MAX- 186 N AVG- 170 N STD DEV=7,9
	Terminal Size ≤ 1.5mm, Force ≥ 80N		N/A	MIN- 174 N MAX- 246 N AVG- 232 N STD DEV=12,1
	Terminal Size ≤ 2.8mm, Force ≥ 100N		MIN- 172 N MAX- 226 N AVG- 200 N STD DEV=17,2	N/A
	Terminal Size ≤ 6.3mm, Force ≥ 120N		MIN- 381 N MAX- 513 N AVG- 462 N STD DEV=50,3	N/A

Results Comments:

Pass

Sequence 4 Group 3 - GMW3191: Terminal from Connector Extraction

Description of Testing:

During Sequence 4, Group 3, terminal extraction from the female connection was measured. Testing performance included virgin connectors that had been moisture-conditioned per GMW3191.

Description of Samples Tested:

90P ECM Female Connector Assembly
112P ECM Female Connector Assembly

Acceptance Criteria:

Terminal from Connector, Primary & Secondary (Post Moisture Conditioning)

Generation Y 0.64mm =	60 N Min
MCON 1.2mm =	80 N Min
MCP 2.8mm =	100 N Min
MCP 6.3mm =	120 N Min

Results Summary:

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Terminal Extraction Force (Primary & Secondary Locks after Moisture Conditioning)	Terminal Size = .64mm, Force ≥ 60N	GMW3191 Para. 4.2.5.4	MIN- 146 N MAX- 180 N AVG- 166 N STD DEV=7.4	MIN- 154 N MAX- 184 N AVG- 168 N STD DEV=7.0
	Terminal Size ≤ 1.5mm, Force ≥ 80N		N/A	MIN- 136 N MAX- 244 N AVG- 225 N STD DEV=26.4
	Terminal Size ≤ 2.8mm, Force ≥ 100N		MIN- 158 N MAX- 211 N AVG- 186 N STD DEV=14.9	N/A
	Terminal Size ≤ 6.3mm, Force ≥ 120N		MIN- 294 N MAX- 454 N AVG- 379 N STD DEV=63.5	N/A

Results Comments:

Pass

Sequence 4 Group 4 - GMW3191: Terminal from Connector Extraction

Description of Testing:

During Sequence 4, Group 4, terminal extraction from the female connection was measured. Testing performance included connectors that had been through the GMW3191 Thermal Aging environment.

Description of Samples Tested:

90P ECM Female Connector Assembly
112P ECM Female Connector Assembly

Acceptance Criteria:

Terminal from Connector, Primary & Secondary (Post Thermal Aging)

Generation Y 0.64mm =	50 N Min
MCON 1.2mm =	70 N Min
MCP 2.8mm =	90 N Min
MCP 6.3mm =	110 N Min

Results Summary:

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Terminal Extraction Force (Primary & Secondary Locks after Thermal Aging)	Terminal Size = .64mm, Force ≥ 50N	GMW3191 Para. 4.2.5.4	MIN- 103 N MAX- 131 N AVG- 119 N STD DEV=6.4	MIN- 107 N MAX- 135 N AVG- 122 N STD DEV=5.7
	Terminal Size ≤ 1.5mm, Force ≥ 70N		N/A	MIN- 157 N MAX- 232 N AVG- 217 N STD DEV=11.4
	Terminal Size ≤ 2.8mm, Force ≥ 90N		MIN- 213 N MAX- 269 N AVG- 242 N STD DEV=16.3	N/A
	Terminal Size ≤ 6.3mm, Force ≥ 110N		MIN- 486 N MAX- 526 N AVG- 506N STD DEV=13.4	N/A

Results Comments:

Pass

Sequence 4 Group 5 - GMW3191: Terminal from Connector Extraction

Description of Testing:

During Sequence 4, Group 4, terminal extraction from the female connection was measured. Testing performance included connectors that had been through the GMW3191 Humid Heat Cyclic environment.

Description of Samples Tested:

90P ECM Female Connector Assembly
112P ECM Female Connector Assembly

Acceptance Criteria:

Terminal from Connector, Primary & Secondary (Post Humid Heat Cyclic)

Generation Y 0.64mm =	50 N Min
MCON 1.2mm =	70 N Min
MCP 2.8mm =	90 N Min
MCP 6.3mm =	110 N Min

Results Summary:

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Terminal Extraction Force (Primary & Secondary Locks after Humid Heat Cyclic)	Terminal Size = .64mm, Force ≥ 50N	GMW3191 Para. 4.2.5.4	MIN- 103 N MAX- 197 N AVG- 168 N STD DEV=14.5	MIN- 160 N MAX- 191 N AVG- 173 N STD DEV=7.0
	Terminal Size ≤ 1.5mm, Force ≥ 70N		N/A	MIN- 166 N MAX- 247 N AVG- 229 N STD DEV=18.5
	Terminal Size ≤ 2.8mm, Force ≥ 90N		MIN- 160 N MAX- 215 N AVG- 192 N STD DEV=15.3	N/A
	Terminal Size ≤ 6.3mm, Force ≥ 110N		MIN- 281 N MAX- 428 N AVG- 374 N STD DEV=56.9	N/A

Results Comments:

Pass

GMW3172 Testing

Sequence 5 Group 1 - GMW3172: Pressure Decay Test& Electrical – Leg 1

Description of Testing:

During Sequence 5, Group 1, the product under test was subjected to the sequence of environments as defined by GMW3172. Applied environments were: Mechanical Shock – Collision and Pothole, Vibration w/ Thermal Shock and Power Temperature Cycling (PTC).

Environmental Classification:

Applied Temperature = -40°C to 125°C with Exception to PTC
PTC Applied Temperature - -40°C to 105°C with Energized Circuits (See Specific Powered Circuit Configurations in Appendix A).

Description of Samples Tested:

8x 90P ECM Female Connector Assembly mated to 90P Denso Controller Header
8x Fully Loaded Max Wire
8x 112P ECM Female Connector Assembly mated to 112P Denso Controller Header
8x Fully Loaded Max Wire

Acceptance Criteria:

Dry Circuit Resistance (Pre and Post Testing)

Generation Y 0.64mm =	15 mΩ Max
MCON 1.2mm =	8 mΩ Max
MCP 2.8mm =	5 mΩ Max
MCP 6.3mm =	1.5 mΩ Max
Pressure Decay =	5 CC/Min - Criteria to be Discussed

Results Summary (Electrical):

TEST	CRITERIA	SPECIFICATION	Post DCR [mΩ] 90P	Post DCR [mΩ] 112P
Sequence 5-1				
Initial	15.0mΩ max for 0.64mm Terminal Size		MIN=3.90 MAX=5.18 AVG=4.40 STDV=.2206	MIN= 3.75 MAX=6.01 AVG=4.15 STDV=.0.2784
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN= 1.31 MAX= 2.51 AVG= 1.649 STDV= 1.0308
	5.0mΩ max for 2.8mm Terminal Size		MIN=0.69 MAX=1.30 AVG=0.91 STDV=0.1420	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN= 0.45 MAX= 0.55 AVG= 0.49 STDV=0.0305	N/A
Mechanical Shock/Vibration with Temperature Cycles	15.0mΩ max for 0.64mm Terminal Size		MIN= 1.55 MAX= 4.63 AVG= 3.98 STDV= 0.4257	MIN= 1.85 MAX=5.46 AVG= 3.92 STDV= 1.2326
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN= 1.53 MAX= 3.82 AVG= 2.40 STDV= .5216
	5.0mΩ max for 2.8mm Terminal Size		MIN= 0.66 MAX= 1.03 AVG= 0.81 STDV= 0.0936	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN= 0.47 MAX= 0.62 AVG= 0.53 STDV= 0.0371	N/A
Thermal Shock	15.0mΩ max for 0.64mm Terminal Size	2018 Diesel ECM Connection System Verification Plan	MIN= 3.22 MAX= 5.79 AVG= 4.45 STDV= 0.4877	MIN= 2.70 MAX= 6.39 AVG= 4.25 STDV= 0.6648
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN= 1.82 MAX= 6.87 AVG= 3.174 STDV= .9118
	5.0mΩ max for 2.8mm Terminal Size		MIN= 0.70 MAX= 3.00 AVG= 1.08 STDV= 0.4428	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN= 0.45 MAX= 0.72 AVG= 0.58 STDV= 0.0683	N/A

Results Summary (Electrical - continued):

TEST	CRITERIA	SPECIFICATION	Post DCR [mΩ] 90P	Post DCR [mΩ] 112P
Sequence 5-1				
PTC	15.0mΩ max for 0.64mm Terminal Size	2018 Diesel ECM Connection System Verification Plan	MIN= 3.51 MAX= 5.72 AVG= 4.33 STDV= 0.43	MIN=3.74 MAX=8.56 AVG=4.324 STDV=0.7378
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN=1.74 MAX=14.66 AVG=3.457 STDV=1.7659
	5.0mΩ max for 2.8mm Terminal Size		MIN= 0.68 MAX= 3.20 AVG= 1.16 STDV= 0.5645	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN= 0.45 MAX= 0.70 AVG= 0.55 STDV= 0.0625	N/A

Results Summary (Pressure Decay):

90P CONNECTION SYSTEM Post Test Pressure Decay Readings - cc/min, 25C, 60% RH				
Sample	SEQ 5-1			
	@ 7psi Initial	@ 4psi Mech	@4 psi Thermal	@ 4psi PTC
1	0.16	0.58	0.95	0.86
2	0.16	0.28	0.67	0.49
3	0.19	0.34	10.52	7.08
4	0.38	0.37	4.12	4.1
5	0.28	1.59	2.49	6.43
6	0.28	0.38	0.62	1.41
7	0.27	0.15	0.34	0.42
8	0.58	0.58	0.95	Fail

112P CONNECTION SYSTEM Post Test Pressure Decay Readings - cc/min, 25C, 60% RH				
Sample	SEQ 5-1			
	@ 7psi Initial	@ 4psi Mech Shock/Vibe	@4 psi Thermal Shock	@ 4psi PTC
1	2.74	2.98	3.59	3.29
2	1.19	0.47	0.83	0.9
3	0.17	0.26	0.53	0.55
4	0.23	0.13	0.27	0.34
5	0.18	0.34	0.58	0.65
6	0.37	0.3	0.26	0.33
7	0.17	1.35	1.89	1.83
8	0.19	0.13	0.3	0.3

Results Comments:

Pressure Decay:

For pressure decay failures on 90P, 3/8 did not meet suggested criteria of 5 cc/min.
For pressure decay on 112P, all pressure decays were < 5 cc/min,

On the 90P, two root causes were identified: 1) Cuts in wire insulation due to high stress concentration from interior cover ribs. 2) Defect in sealing surface in 90P header.

Results Comments (continued):

Dry Circuit Resistance:

0.64 – 80/80 Circuits Passed
1.2mm – 78/80 Circuits Passed
2.8mm – 64/64 Circuits Passed
6.3mm – 16/16 Circuits Passed

For the 1.2mm contacts, all dry circuit resistance values were less than 15mΩ. The high resistance was identified to be in the crimp of the contact – with stable contact interfaces. TE had identified crimp improvements and has submitted a re-test plan to GM for these improvements.

Sequence 5 Group 2 - GMW3172: Pressure Decay Test & Electrical – Leg 2

Description of Testing:

During Sequence 5, Group 2, the product under test was subjected to the sequence of environments as defined by GMW3172. Applied environments were: Humid Heat Cyclic, Thermal Shock, Power Temperature Cycling (PTC), Mechanical Shock – Collision and Pothole, Vibration w/ Thermal Cycling.

Environmental Classification:

Applied Temperature = -40°C to 125°C with Exception to PTC
PTC Applied Temperature - -40°C to 105°C with Energized Circuits (See Specific Powered Circuit Configurations in Appendix A).

Description of Samples Tested:

8x 90P ECM Female Connector Assembly mated to 90P Denso Controller Header
8x Fully Loaded Max Wire
8x 112P ECM Female Connector Assembly mated to 112P Denso Controller Header
8x Fully Loaded Max Wire

Acceptance Criteria:

Dry Circuit Resistance (Pre and Post Testing)

Generation Y 0.64mm =	15 mΩ Max
MCON 1.2mm =	8 mΩ Max
MCP 2.8mm =	5 mΩ Max
MCP 6.3mm =	1.5 mΩ Max
Pressure Decay =	5 CC/Min - Criteria to be Discussed

Results Summary (Electrical):

TEST	CRITERIA	SPECIFICATION	Post DCR [mΩ] 90P	Post DCR [mΩ] 112P	Post DCR [mΩ] 90P	Post DCR [mΩ] 112P
			Sequence 5-2A		Sequence 5-2B	
Initial	15.0mΩ max for 0.64mm Terminal Size		MIN=3.92 MAX=5.12 AVG=4.24 STDV=0.1864	MIN=3.90 MAX=4.45 AVG=4.22 STDV=0.1498	MIN=3.44 MAX=4.90 AVG=3.80 STDV=0.2205	MIN=3.95 MAX=4.73 AVG=4.28 STDV=0.1624
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN=1.42 MAX=2.94 AVG=1.88 STDV=0.3784	N/A	MIN=1.22 MAX=2.20 AVG=1.57 STDV=0.2212
	5.0mΩ max for 2.8mm Terminal Size		MIN=0.74 MAX=1.08 AVG=0.862 STDV=0.0745	N/A	MIN=0.67 MAX=1.02 AVG=0.843 STDV=0.0820	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN=0.42 MAX=0.51 AVG=0.46 STDV=0.0355	N/A	MIN=0.42 MAX=0.51 AVG=0.451 STDV=0.0336	N/A
HHC	15.0mΩ max for 0.64mm Terminal Size		MIN=3.58 MAX=4.10 AVG=3.80 STDV=0.1120	MIN=3.84 MAX=4.60 AVG=4.23 STDV=0.1626	MIN= MAX=3.89 AVG= STDV=	MIN=4.06 MAX=4.41 AVG=4.29 STDV=0.1557
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN=1.66 MAX=6.14 AVG=2.72 STDV=0.9538	N/A	MIN=1.37 MAX=3.11 AVG=2.00 STDV=0.3432
	5.0mΩ max for 2.8mm Terminal Size		MIN=0.74 MAX=1.53 AVG=0.95 STDV=0.1788	N/A	MIN=0.68 MAX=1.02 AVG=0.84 STDV=0.0957	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN=0.43 MAX=0.54 AVG=0.469 STDV=0.0352	N/A	MIN= MAX=0.60 AVG= STDV=	N/A
T-Shock	15.0mΩ max for 0.64mm Terminal Size		MIN=3.57 MAX=4.37 AVG=3.84 STDV=.1601	MIN=3.94 MAX=5.40 AVG=4.29 STDV=0.3080	MIN=3.42 MAX=5.12 AVG=3.97 STDV=0.3445	MIN=3.96 MAX=5.82 AVG=0.33 STDV=0.3848
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN=1.94 MAX=10.31 AVG=4.378 STDV=2.1063	N/A	MIN=2.05 MAX=5.44 AVG=3.048 STDV=0.7105
	5.0mΩ max for 2.8mm Terminal Size		MIN=0.79 MAX=1.70 AVG=1.05 STDV=0.2270	N/A	MIN=0.68 MAX=1.42 AVG=0.95 STDV=0.1667	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN=0.46 MAX=0.64 AVG=0.54 STDV=0.609	N/A	MIN=0.48 MAX=0.77 AVG=0.56 STDV=0.0923	N/A

Results Summary (Electrical - continued):

TEST	CRITERIA	SPECIFICATION	Post DCR [mΩ] 90P	Post DCR [mΩ] 112P	Post DCR [mΩ] 90P	Post DCR [mΩ] 112P
Sequence 5-2A					Sequence 5-2B	
PTC	15.0mΩ max for 0.64mm Terminal Size	2018 Diesel ECM Connection System Verification Plan	MIN= 3.35 MAX= 4.24 AVG= 3.697 STDV=0.2125	MIN=3.88 MAX=5.40 AVG=4.429 STDV=0.3961	MIN=3.30 MAX=4.77 AVG=3.768 STDV=0.2955	MIN=3.94 MAX=5.13 AVG=4.368 STDV=0.2739
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN=1.94 MAX=6.69 AVG=3.818 STDV=1.3863	N/A	MIN=1.42 MAX=6.61 AVG=2.879 STDV=1.0434
	5.0mΩ max for 2.8mm Terminal Size		MIN= 0.76 MAX= 1.91 AVG= 1.156 STDV= 0.3498	N/A	MIN= 0.65 MAX= 1.52 AVG=0.909 STDV=0.1915	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN= 0.44 MAX= 0.62 AVG= 0.520 STDV= 0.0709	N/A	MIN=0.44 MAX=0.73 AVG=0.543 STDV= 0.1002	N/A
Mechanical Shock/Vibration with Temperature Cycles	15.0mΩ max for 0.64mm Terminal Size	2018 Diesel ECM Connection System Verification Plan			MIN=1.29 MAX=4.65 AVG=3.555 STDV=0.6343	MIN=3.95 MAX=5.96 AVG=4.524 STDV=0.5273
	8.0 mΩ max for 1.2mm Terminal Size				N/A	MIN=2.03 MAX=10.0 AVG=3.597 STDV=1.6634
	5.0mΩ max for 2.8mm Terminal Size				MIN=0.72 MAX=1.56 AVG=0.967 STDV=0.1865	N/A
	1.5 mΩ max for 6.3mm Terminal Size				MIN=0.47 MAX=1.07 AVG=0.681 STDV=0.2071	N/A

Results Summary (Pressure Decay):

90P CONNECTION SYSTEM Post Test Pressure Decay Readings - cc/min, 25C, 60% RH				
	SEQ 5-2a			
Sample	@ 7psi Intial	@ 4psi HHC	@4 psi Thermal	@ 4psi PTC
1	0.18	0.21	2.17	9.71
2	0.22	0.56	2.17	Fail
3	3.08	2.86	4.12	5.53
4	2.59	4.04	4.11	1.96
5				
6				
7				
8				

90P CONNECTION SYSTEM Post Test Pressure Decay Readings - cc/min, 25C, 60% RH					
	SEQ 5-2b				
Sample	@ 7psi Intial	@ 4psi HHC	@4 psi Thermal	@ 4psi PTC	@4 psi Mech
1	0.59	0.27	0.37	1.66	2.18
2	0.14	3.32	4.73	1.85	1.82
3	0.18	0.69	0.33	0.42	0.58
4	0.17	0.65	0.48	1.3	1.23
5					
6					
7					
8					

112P CONNECTION SYSTEM Post Test Pressure Decay Readings - cc/min, 25C, 60% RH				
	SEQ 5-2a			
Sample	@ 7psi Intial	@ 4psi HHC	@4 psi Thermal Shock	@ 4psi PTC
1	0.19	0.13	0.17	0.55
2	0.16	0.14	0.15	0.73
3	0.15	0.13	0.14	0.42
4	0.16	0.11	0.12	0.43
5				
6				
7				
8				

112P CONNECTION SYSTEM Post Test Pressure Decay Readings - cc/min, 25C, 60% RH					
	SEQ 5-2b				
Sample	@ 7psi Intial	@ 4psi HHC	@4 psi Thermal Shock	@ 4psi PTC	@4 psi Mech Shock/Vibe
1	0.14	0.22	0.27	0.55	0.76
2	0.12	0.12	0.14	0.42	0.74
3	0.12	0.23	0.23	0.59	0.63
4	0.13	0.12	0.14	0.48	0.64
5					
6					
7					
8					

Results Comments:

Pressure Decay:

For pressure decay failures on 90P, 3/8 did not meet suggested criteria of 5 cc/min.
For pressure decay on 112P, all pressure decays were < 5 cc/min.

On the 90P, two root causes were identified: 1) Cuts in wire insulation due to high stress concentration from interior cover ribs. 2) Defect in sealing surface in 90P header.

Results Comments (continued):

Dry Circuit Resistance:

0.64 – 80/80 Circuits Passed
1.2mm – 78/80 Circuits Passed
2.8mm – 64/64 Circuits Passed
6.3mm – 16/16 Circuits Passed

For the 1.2mm contacts, all dry circuit resistance values were less than 15mΩ. The high resistance was identified to be in the crimp of the contact – with stable contact interfaces. TE had identified crimp improvements and has submitted a re-test plan to GM for these improvements.

Sequence 5 Group 3 - GMW3172: Pressure Decay Test & Electrical – Leg 3

Description of Testing:

During Sequence 5, Group 3, the product under test was subjected to the sequence of environments as defined by GMW3172. Applied environments were: Humid Heat Constant, Thermal Shock, Power Temperature Cycling (PTC), Enclosure Protection (IP6K9K & IPx8).

Environmental Classification:

Applied Temperature = -40°C to 125°C with Exception to PTC
PTC Applied Temperature - -40°C to 105°C with Energized Circuits (See Specific Powered Circuit Configurations in Appendix A).

Description of Samples Tested:

8x 90P ECM Female Connector Assembly mated to 90P Denso Controller Header
8x Fully Loaded Max Wire
8x 112P ECM Female Connector Assembly mated to 112P Denso Controller Header
8x Fully Loaded Max Wire

Acceptance Criteria:

Dry Circuit Resistance (Pre and Post Testing)

Generation Y 0.64mm =	15 mΩ Max
MCON 1.2mm =	8 mΩ Max
MCP 2.8mm =	5 mΩ Max
MCP 6.3mm =	1.5 mΩ Max
Pressure Decay =	5 CC/Min - Criteria to be Discussed

Results Summary (Electrical):

TEST	CRITERIA	SPECIFICATION	Post DCR [mΩ] 90P	Post DCR [mΩ] 112P	Post DCR [mΩ] 90P	Post DCR [mΩ] 112P
Sequence 5-3A					Sequence 5-3B	
Initial	15.0mΩ max for 0.64mm Terminal Size		MIN=4.53 MAX=5.86 AVG=5.154 STDV=0.3640	MIN=3.83 MAX=4.74 AVG=2.266 STDV=0.1576	MIN=3.99 MAX=4.94 AVG=4.471 STDV=0.2269	MIN=4.09 MAX=4.56 AVG=4.281 STDV=.1213
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN=1.47 MAX=2.38 AVG=1.846 STDV=.2314	N/A	MIN=1.29 MAX=2.78 AVG=1.624 STDV=0.3046
	5.0mΩ max for 2.8mm Terminal Size		MIN=0.82 MAX=1.07 AVG=0.935 STDV=0.0708	N/A	MIN=0.75 MAX=1.10 AVG=0.860 STDV=0.0836	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN=0.48 MAX=0.59 AVG=0.516 STDV=0.0342	N/A	MIN=0.45 MAX=0.52 AVG=0.476 STDV=0.0233	N/A
HHCO	15.0mΩ max for 0.64mm Terminal Size		MIN=3.99 MAX=4.97 AVG=4.364 STDV=0.2504	MIN=3.72 MAX=4.35 AVG=4.08 STDV=.1203	MIN=3.89 MAX=4.71 AVG=4.308 STDV=0.1902	MIN=3.91 MAX=4.37 AVG=4.127 STDV=0.1218
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN=1.46 MAX=2.67 AVG=2.054 STDV=0.2643	N/A	MIN=1.24 MAX=4.09 AVG=1.933 STDV=0.6428
	5.0mΩ max for 2.8mm Terminal Size		MIN=0.65 MAX=1.09 AVG=0.817 STDV=0.059	N/A	MIN=0.72 MAX=0.95 AVG=0.818 STDV=0.0578	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN=0.45 MAX=0.53 AVG=0.483 STDV=0.0292	N/A	MIN=0.46 MAX=0.52 AVG=0.486 STDV=0.02	N/A
T-Shock	15.0mΩ max for 0.64mm Terminal Size		MIN=4.02 MAX=7.03 AVG=4.897 STDV=0.6381	MIN=3.79 MAX=5.52 AVG=4.392 STDV=0.3830	MIN=3.99 MAX=6.23 AVG=4.799 STDV=0.5167	MIN=3.93 MAX=5.11 AVG=4.353 STDV=0.2753
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN=1.93 MAX=4.44 AVG=3.031 STDV=0.600	N/A	MIN=1.36 MAX=6.41 AVG=2.426 STDV=1.0636
	5.0mΩ max for 2.8mm Terminal Size		MIN=0.73 MAX=1.14 AVG=0.858 STDV=0.1153	N/A	MIN=0.75 MAX=1.01 AVG=0.841 STDV=0.0673	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN=0.47 MAX=0.57 AVG=0.514 STDV=0.0374	N/A	MIN=0.48 MAX=0.56 AVG=0.514 STDV=0.0362	N/A

Results Summary (Electrical – continued)

TEST	CRITERIA	SPECIFICATION	Post DCR [mΩ] 90P	Post DCR [mΩ] 112P	Post DCR [mΩ] 90P	Post DCR [mΩ] 112P
Sequence 5-3A					Sequence 5-3B	
PTC	15.0mΩ max for 0.64mm Terminal Size	2018 Diesel ECM Connection System Verification Plan	MIN=3.91 MAX=6.85 AVG=4.785 STDV=0.6157	MIN=3.80 MAX=5.46 AVG=4.353 STDV=0.3432	MIN=3.85 MAX=5.96 AVG=4.681 STDV=0.3846	MIN=3.89 MAX=5.06 AVG=4.31 STDV=0.2664
	8.0 mΩ max for 1.2mm Terminal Size		N/A	MIN=2.01 MAX=5.15 AVG=3.095 STDV=.6416	N/A	MIN=1.32 MAX=6.78 AVG=2.404 STDV=1.1113
	5.0mΩ max for 2.8mm Terminal Size		MIN=0.70 MAX=1.14 AVG=0.830 STDV=0.1194	N/A	MIN=0.71 MAX=1.17 AVG=0.820 STDV=0.1044	N/A
	1.5 mΩ max for 6.3mm Terminal Size		MIN=0.43 MAX=0.52 AVG=0.478 STDV=0.0306	N/A	MIN=0.42 MAX=0.49 AVG=0.453 STDV=0.0212	N/A
Mechanical Shock/Vibration with Temperature Cycles	15.0mΩ max for 0.64mm Terminal Size	2018 Diesel ECM Connection System Verification Plan			MIN=3.89 MAX=6.01 AVG=4.695 STDV=0.4362	MIN=3.77 MAX=5.56 AVG=4.447 STDV=0.4873
	8.0 mΩ max for 1.2mm Terminal Size				N/A	MIN=1.49 MAX=11.21 AVG=3.288 STDV=2.0549
	5.0mΩ max for 2.8mm Terminal Size				MIN=0.70 MAX=1.23 AVG=0.835 STDV=0.1141	N/A
	1.5 mΩ max for 6.3mm Terminal Size				MIN=0.42 MAX=0.50 AVG=0.454 STDV=0.0262	N/A

Results Summary (Pressure Decay):

90P CONNECTION SYSTEM Post Test Pressure Decay Readings - cc/min, 25C, 60% RH					90P CONNECTION SYSTEM Post Test Pressure Decay Readings - cc/min, 25C, 60% RH					
	SEQ 5-3a					SEQ 5-3b				
Sample	@ 7psi Intial	@ 4psi HHCO	@4 psi Thermal	@ 4psi PTC	Sample	@ 7psi Intial	@ 4psi HHCO	@4 psi Thermal	@ 4psi PTC	@4 psi Mech
1	0.91	1.39	2.78	9.33	1	0.32	0.64	1.4	13.67	8.74
2	0.21	0.08	0.85	11.98	2	0.19	0.15	0.5	13.94	14.27
3	0.18	2.55	1.37	4.4	3	0.19	0.09	3.91	10.67	11.99
4	0.18	0.1	1.11	Fail	4	0.21	0.75	4.48	13.06	13.32
5					5					
6					6					
7					7					
8					8					

112P CONNECTION SYSTEM Post Test Pressure Decay Readings - cc/min, 25C, 60% RH					112P CONNECTION SYSTEM Post Test Pressure Decay Readings - cc/min, 25C, 60% RH					
	SEQ 5-3a					SEQ 5-3b				
Sample	@ 7psi Intial	@ 4psi HHCO	@4 psi Thermal Shock	@ 4psi PTC	Sample	@ 7psi Intial	@ 4psi HHCO	@4 psi Thermal Shock	@ 4psi PTC	@4 psi Mech Shock/Vi
1	0.07	0.08	0.08	0.6	1	0.17	0.1	0.09	0.37	0.08
2	0.18	0.16	0.08	0.87	2	0.12	0.17	0.08	0.46	0.58
3	0.21	0.18	0.07	0.43	3	0.13	0.18	0.08	0.48	0.76
4	0.15	0.17	0.15	0.38	4	0.13	0.09	0.07	0.78	0.99
5					5					
6					6					
7					7					
8					8					

Results Comments:

Pressure Decay:

For pressure decay failures on 90P, 7/8 did not meet suggested criteria of 5 cc/min.
For pressure decay on 112P, all pressure decays were < 5 cc/min.

On the 90P, two root causes were identified: 1) Cuts in wire insulation due to high stress concentration from interior cover ribs. 2) Defect in sealing surface in 90P header.

Results Comments (continued):

Dry Circuit Resistance:

0.64 – 80/80 Circuits Passed
1.2mm – 79/80 Circuits Passed
2.8mm – 64/64 Circuits Passed
6.3mm – 16/16 Circuits Passed

For the 1.2mm contacts, all dry circuit resistance values were less than 15mΩ. The high resistance was identified to be in the crimp of the contact – with stable contact interfaces. TE had identified crimp improvements and has submitted a re-test plan to GM for these improvements.

Sequence 5 Group 4 - GMW3172: Salt Spray/Submersion – Leg 4

Description of Testing:

During Sequence 5, Group 4, the product under test was subjected to the sequence of environments as defined by GMW3172. Applied environments were: Salt Spray (40 Days) and Enclosure Protection (IP6K9K & IPx8).

Environmental Classification:

Salt Spray per GMW3172, 9.4.8

Description of Samples Tested:

8x 90P ECM Female Connector Assembly mated to 90P Denso Controller Header
- 2x Fully Loaded Max Wire
- 4x Fully Loaded Min Wire
- 2x Fully Loaded Mixture of Min and Max

8x 112P ECM Female Connector Assembly mated to 112P Denso Controller Header
- 2x Fully Loaded Max Wire
- 4x Fully Loaded Min Wire
- 2x Fully Loaded Mixture of Min and Max

Acceptance Criteria:

Pre-Environment Pressure =	7 PSI Min
Pre-Environment Vacuum =	7 PSI Min
Post-Environment Pressure =	4 PSI Min
Post-Environment Vacuum =	4 PSI Min
Isolation Resistance =	100 Mohms at 500VDC
Post-Sequence Dielectric Strength=	No Breakdown or Flashover

Results Summary:

Sample Number	Resistance at 500 Vdc (GΩ)										
	Initial	After Pressure/Vacuum +/- 7 psig	After Salt Spray	After Dust	After Water Spray	Cycle 1 Water Submersion	Cycle 2 Water Submersion	Cycle 3 Water Submersion	Cycle 4 Water Submersion	Cycle 5 Water Submersion	After Pressure/Vacuum (after Submersion)
Min-1	22.27	36	39.69	>60	>60	>60	>60	>60	>60	>60	>60
Min-2	34.4	46.2	27.89	51.59	>60	>60	>60	>60	>60	>60	>60
Min-3	20.64	43.6	41.83	>60	>60	>60	>60	>60	>60	>60	>60
Min-4	34.4	51.59	>60	>60	>60	>60	>60	>60	>60	>60	>60
Mid-1	27.65	12.33	26.23	50.75	>60	>60	>60	>60	>60	>60	>60
Mid-2	27.15	31.91	24.18	31.59	>60	<10KΩ	N/A	N/A	N/A	N/A	N/A
Max-1	14.2	16.47	34.02	24.76	>60	>60	>60	>60	>60	>60	>60
Max-2	31.59	36.42	22.43	41.83	>60	>60	>60	>60	>60	>60	>60

Results Comments:

All pass except Mid-2 sample. Sample was investigated, and it was observed that the pressure tube was not inserted sufficiently passed the mat seal gland, such that during extension of the cable bundle to perform submersion test fluid inadvertently pass into the connector. The open sample was dried in chamber at 85C for 72 hours. The sample was then mated and IR greater than 100Mohm verified. The sample was then subjected to addition 4 submersion per test specification which resulted in all isolation resistance pass values.

ISL Change Sub-Set Retest - GMW3191: Generation Y Terminals

Terminal Engagement, Terminal Extraction, and Terminal Position Assurance

Description of Testing:

Group ISL Change Sub-Set Retest is support testing for modifications that were made after connector validation was initialized. Testing includes terminal engagement, terminal extraction and terminal position assurance for the Generation Y receptacle contact. Prior to testing, the conditioning sequence per GMW3191, section 3.3 was applied to plastic components.

Description of Samples Tested:

90P ECM Female Connector Assembly
112P ECM Female Connector Assembly

Acceptance Criteria:

Terminal Engagement
Generation Y 0.64mm Maximum Insertion = 15N Min
Terminal from Connector, Primary Lock
Generation Y 0.64mm = 30 N Min
Terminal Position Assurance
Pre-Lock to Lock w/ Terminals = 20 – 45 N

Results Summary:

Terminal Engagement

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Terminal Engagement Force - ISL in open Position	0.64mm(0.75mm^2)< 15N	GMW 3191 Para. 4.2.4.4.1	MIN=4.5N MAX=9.3N AVG=6.25N STD DEV=1.19	MIN=4.72N MAX=10.6N AVG=6.14N STD DEV=1.24
	0.64mm(0.35mm^2)< 15N		MIN=2.69N MAX=7.51N AVG=4.94N STD DEV=1.54	MIN=2.45N MAX=4.98N AVG=3.08N STD DEV=0.489

Results Comments:

Pass

Terminal Extraction

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Terminal From Connector Extraction-Primary, G-Y	Terminal Size = .64mm, Force ≥ 30N	GMW3191 Para. 4.2.5.4	MIN=30.1 N MAX=37N AVG=33.1N STD DEV=1.66	MIN=30.1 N MAX=37 N AVG=32.9 N STD DEV=1.7
Terminal From Connector Extraction-Primar+Secondary, G-Y	Terminal Size = .64mm, Force ≥ 60N		MIN=142N MAX=187N AVG=167N STD DEV=11.5	MIN=142N MAX=187N AVG=167N STD DEV=9.4

Results Comments:

Pass

Terminal Position Assurance

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
ISL Pre-Lock to Locked Force with Properly Assembled Terminals	Protected ISL: 20N Min. / 45N Max.	GMW3191 Para. 4.2.9.4.2	Side A MIN = 21.2N MAX = 24.4N AVG = 23.1N STD DEV = 1.03 Side B MIN = 20.2N MAX = 25.0N AVG = 22.4N STD DEV = 1.81	Side A MIN = 23.4N MAX = 29.7N AVG = 27.9N STD DEV = 2.0 Side B MIN = 21.3N MAX = 31.0N AVG = 26.2N STD DEV = 2.83

Results Comments:

Pass

Lever Change to Rev 2 Sub-Set Retest -

Connector to Connector Tests, Mechanical Assist Integrity, USCAR2 Drop, GMPT Hanging Test

Description of Testing:

Lever Change to Rev 2 Sub-Set Retest is support testing for modifications that were made after connector validation was initialized to the lever which increased clearance for terminal insertion. Testing includes connector engage to pre-stage, connector to connector engage, engage CPA to lock, connector to connector disengage, connector removal from pre-stage, retention of lever in open position, lever and slide force strength, USCAR2 drop test, and GMPT pre-stage retention test. Prior to testing, the conditioning sequence per GMW3191, section 3.3 was applied to plastic components.

Description of Samples Tested:

Connector to Connector Tests:	
10x 90P ECM Female Connector Assembly	Fully Loaded
10x 112P ECM Female Connector Assembly	Fully Loaded
Pre-stage Retention	
3x 90P ECM Female Connector Assembly	Fully Loaded
3x 112P ECM Female Connector Assembly	Fully Loaded
Drop Test	
18x 90P ECM Female Connector Assembly	
18x 112P ECM Female Connector Assembly	
Mechanical Assist Integrity Tests	
10x 90P ECM Female Connector Assembly	
10x 112P ECM Female Connector Assembly	

Acceptance Criteria:

Retention of Lever in Open Position=	150N Min
Connector Engage to Pre-stage =	75N Max
Connector Disengage from Pre-stage =	6N Min – 75NMax
Connector to Connector Engage =	75N Max
Connector to Connector Disengage=	75N Max
CPA Engage Pre-lock to Lock =	22N Max
CPA Engage Lock to Pre-Lock =	10N to 30N
Connector Drop Test	Pass
Hanging Test	Pass

Retention of Lever in Open Position

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Retention of Lever in Open Position	Withstands 150N without inadvertent closure.	GMW3191 Para. 4.2.10.4	MIN=150N	MIN=150N

Results Comments:

Pass

Connector Engage/Disengage to Pre-stage

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Force to engage connector to pre-stage position	75N Max.	GMW3191 Para 4.2.8	MIN=31.6N MAX=48.4N AVG=41.2N STD DEV=9.13	MIN = 33.2N MAX = 44N AVG-=39.1N STD DEV=3.88
Force to remove connector from pre-stage position	15N Min. to 75N Max.	GMW3191 Para 4.2.8	MIN=19.7N MAX=26.4N AVG= 23.4N STD DEV=2.53	MIN=20N MAX=25.4N AVG=23.2N STD DEV=1.75

Results Comments:

Pass

Connector to Connector Engage/Disengage

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Force to move lever to locked position. Test Performed with EMEA torque monitor test stand. All terminal locations populated.	75N Max.	GMW3191 Para 4.2.8	MIN= 44.6N MAX= 60N AVG= 53.5N STDEV= 5.66N	MIN= 42N MAX= 50.6N AVG= 46.8N STDEV= 2.81N
Force to move lever from locked position. Test performed with EMEA torque monitor test stand. All terminal locations populated.	75N Max.	GMW3191 Para 4.2.8	MIN= 36N MAX= 41.3N AVG= 39.1N STDEV= 1.59N	MIN= 34N MAX= 46N AVG= 39.8N STDEV= 3.74N

Results Comments:

Pass

CPA Engage to Lock

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
CPA pre-stage to lock force (Mated)	CPA pre-stage to lock force shall be 22 N maximum..	GMW3191 Para. 4.2.15.4.1	MIN= 8.8N MAX= 13.7N AVG=10.5N STD DEV=1.35	MIN= 8.86 N MAX= 11.5N AVG= 10.1N STD DEV=0.86
CPA Unlock Force (Mated)	CPA lock to pre-lock force: 10N to 30N	GMW3191 Para. 4.2.15.4.1	MIN= 10N MAX= 12.4N AVG= 11.4N STD DEV=0.844	MIN=10.6N MAX= 14.3N AVG= 12.8N STD DEV=1.04

Results Comments:

Pass

Hanging Test

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Pre-Stage Retention Test (Hanging Test)	Retain to header in pre-stage position in inverted position with 1 meter of harness	GMPT DRE	Passed	Passed

Results Comments:

Pass

Connector Drop Test

TEST	CRITERIA	SPECIFICATION	Multi-Cavity 90P	Multi-Cavity 112P
Connector Drop Test	No damage that could affect functionality	USCAR2 Para 5.4.8	Passed	Passed

Results Comments:

Pass

Appendix

A. PTC Power Circuit Configuration

90P

Circuit Nbr.	Circuit Description
1, 46	6.3mm Power Circuits - 30.6A
2, 23, 24 ,45, 47, 68, 69, 90	2.8mm Power Circuits - 12.7 A
11, 13, 20, 34, 56, 58, 65, 79	0.64 Signal Circuits - 4.0A
3, 48	0.64 millamp Circuits - 300mA

112P

Circuit Nbr.	Circuit Description
2, 3, 4, 30, 31, 58, 59, 60, 86, 87	1.2mm Power Circuits - 8.1A
15, 25, 26, 54, 70, 82, 83, 111	0.64 Signal Circuits - 4.0A
5, 61	0.64 millamp Circuits - 300mA

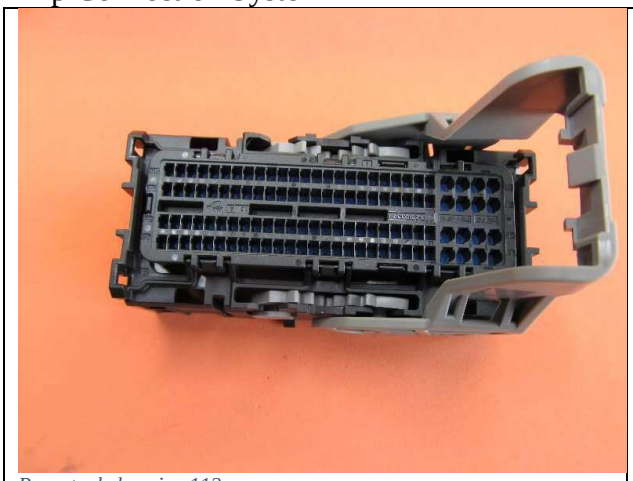
B. Circuit Loading Configurations

WIRE POPULATION STRATEGY													
TERMINAL SIZE mm	WIRE SIZE mm^2	MAX. CABLE BUNDLE POPULATION		MED. CABLE POPULATION		MIN. CABLE POPULATION		MAX. CABLE BUNDLE POPULATION [Salt Spray Tests]		MEDIUM CABLE BUNDLE POPULATION [Salt Spray Tests]		MIN. CABLE BUNDLE POPULATION [Salt Spray Tests]	
		112P	90P	112P	90P	112P	90P	112P	90P	112P	90P	112P	90P
0.64	0.35	20	4	56	44	96	80	20	4	46	26	80	64
0.64	0.5	55	48	32	20			55	48	34	38		
0.64	0.75	21	28	8	16			21	28	16	16	16	16
1.2	0.75			8		16							
1.2	1.5	16		8				16		16		16	
2.8	0.5				4		8						
2.8	2.5		8		4				8		8		8
6.3	0.5				1		2						
6.3	6		2		1				2		2		2
CKT CNT		112	90	112	90	112	90	112	90	112	90	112	90
CABLE BUNDLE AREA $[mm^2]$		359	356	294	262	230	168	359	356	329	323	299	288

All environmental test wire insulation to ISO 6722-1, 150C Cross Link Thin Wall

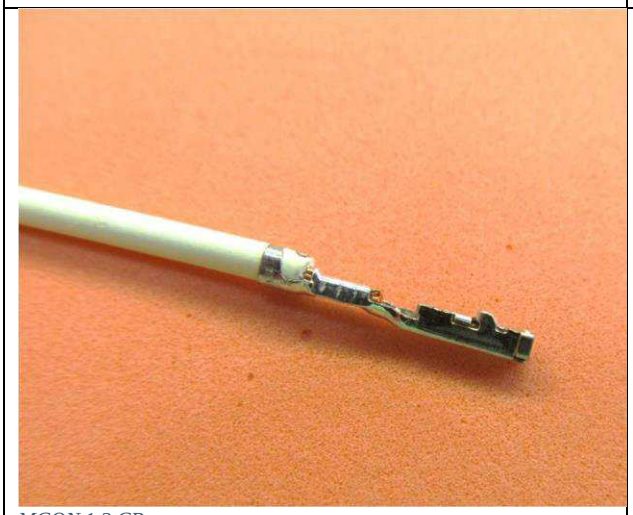
C. Applicable Components Photos

112p Connection System

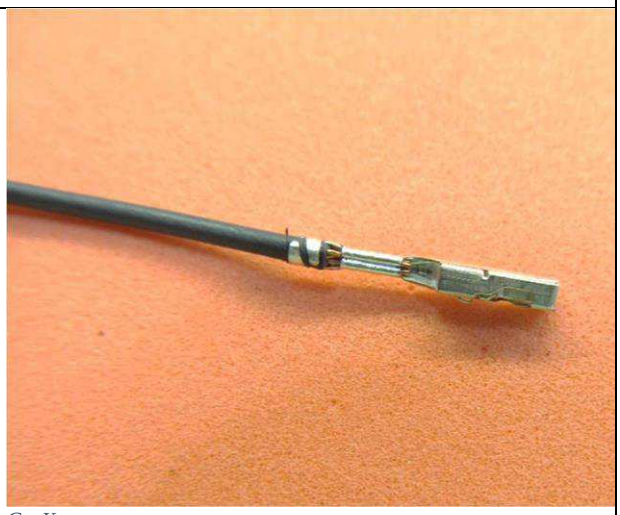


Receptacle housing 112 pos.

Header 112 pos.



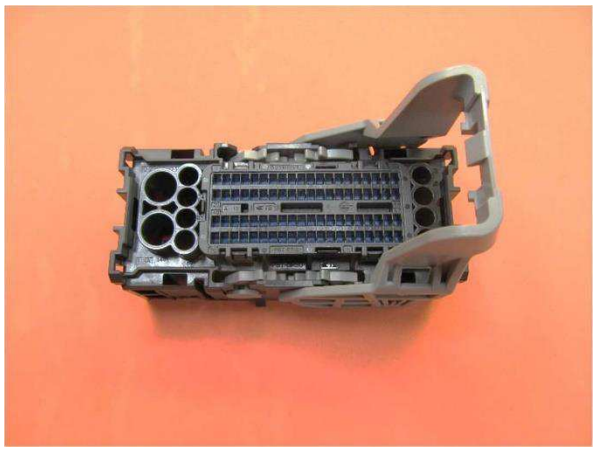
MCON 1.2 CB



GenY contact

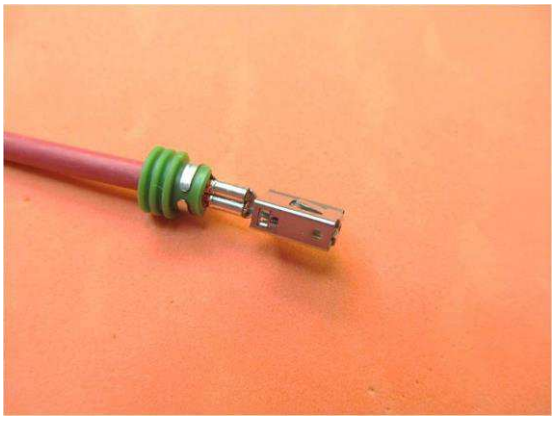
Wire Dress Cover – 90P and 112P

90P Connection System



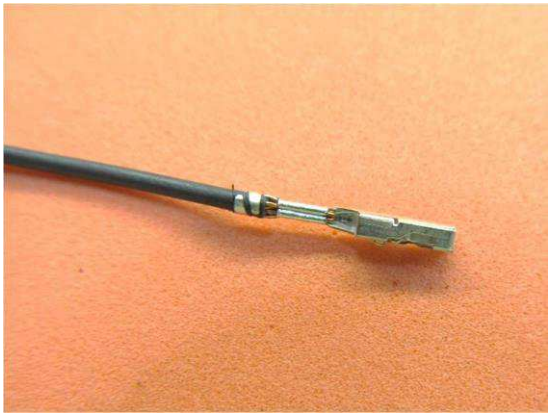
Receptacle housing 90 pos.

Header 90 pos.



MCP 6.3 w/SWS

MCP 2.8 w/SWS



GenY contact

Wire Dress Cover w/CPA – 90P and 112P