

CONSERFLOW S.A. DE C.V.			
	INSPECTION FOR POWER CABLE INSTALLATIONS, CONTROL AND INSTRUMENTATION	CODE	PCC-09
		REVISION	02
		EMISSION	12.APR.23

SIGNATURE CONTROL		
DEVELOPED	REVISED	AUTHORIZED
Lic. Karla Alamillo Reyes NAME	Eng. Areli Roque Cruz NAME	Eng. Diego Cruz Martínez NAME
SIGNATURE	SIGNATURE	SIGNATURE
IMS Administrator STAND	Quality Control Manager STAND	General Directorate STAND

CHANGE CONTROL		
DESCRIPTION OF THE CHANGE	REVISION	DATE
The translation of this PCC-09 procedure is included in the IMS, and the English version is integrated with the same control data as the Spanish document. Modification of associated formats for handling the English-Spanish version.	02	12.APR.23
Integration of Reference Documents, Definitions, and Responsibilities sections	01	13.AUG.22
Issuance of the Procedure.	00	28.JUN.21

PURPOSE OF THE PROCEDURE

Establish the guidelines to carry out an effective inspection on the installation of power, control, and instrumentation cables.

SCOPE OF THE PROCEDURE

This procedure applies to all projects that require the installation of power, control, and instrumentation cables, as well as to all personnel involved in the activity.

REFERENCE DOCUMENTS

- International Quality Management Systems ISO 9001:2015 Standard
- International Standard Environmental Management Systems ISO 14001:2015
- NOM-001-SEDE Electrical installations (use).
- NOM-029-STPS-2011 Maintenance of Electrical Installations in Work Centers - Safety Conditions.
- NOM-09-STPS-2011 Work at Heights.
- NOM-017-STPS-2008 Personal Protective Equipment.
- NOM-026-STPS-2008 Safety and Hygiene Cables and Signs and Identification of Fluid Hazards.
- IEEE C57.12.90-1993 "IEEE Standard test code for liquid-immersed distribution, power, and regulating transformers and IEEE guide for short-circuit testing of distribution and power transformers."

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DEFINITIONS

Conduit Pipe: It is a pipe that is used for the protection and channeling of the electrical wiring of electrical installations, whether residential, commercial, or industrial. This electrical conduit pipe is characterized by its thick wall or thin wall, in addition to the fact that it is a tube that can be rigid or flexible.

Continuity test: This is a quick check to see if a circuit is open or closed. Only a closed and complete (connected) circuit has continuity. During a continuity test, a digital multimeter sends a small current through the circuit to measure the resistance in the circuit.

Digital Multimeter (DMM): It is a testing instrument used to measure two or more electrical values, mainly voltage (volts), current (amps), and resistance (ohms). It is a standard diagnostic tool for technicians in the electrical and electronics industries.

RESPONSIBILITIES

Quality Control Inspector:

- Witness and verify continuity testing
- Check and inspect the installation of the cables.
- Carry out the appropriate documentation according to this procedure.

Construction Supervision:

- Supervises the installation of the wiring according to the construction schedule.
- Verify that the test is performed properly.

Electrical or Electrical Engineer:

- Carry out the proper installation of the electrical wiring according to the plans and their work instructions.
- Take the continuity test.
- Carry out the activities following the applicable regulations
- Carry out waste management properly.



**INSPECTION FOR POWER CABLE
INSTALLATIONS, CONTROL AND
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
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DESCRIPTION OF THE PROCEDURE

Responsible	Activity	Records																																																																																							
Quality Inspector	<p>1. NUMBER OF CONDUCTORS IN CONDUIT TUBES</p> <p>The capacity of electrical conductors is limited for heating reasons, as there are maximum levels of heat dissipation, in addition to the fact that insulation imposes a strong restriction due to its limitations.</p> <p>For this reason, the number of conductors within a conduit has to be restricted to allow their physical arrangement according to the section of the tube, to facilitate accommodation and handling during the installation of the conductors, and also to consider the amount of air necessary for them to be maintained at adequate temperatures based on adequate cooling, as established in the following table.</p> <p>Board 1 Heavy, medium, and light-type metal conduit dimensions and areas available for conductors.</p> <table><tr><th rowspan="2">Nominal size mm</th><th rowspan="2">Inner diameter mm</th><th rowspan="2">Total interior area mm2</th><th colspan="3">Area available for mm2 conductors</th></tr><tr><th>One conductor FR=53%</th><th>Two conductors FR=31%</th><th>More than two conductors FR = 40%</th></tr><tr><td>16 (1/2)</td><td>15.8</td><td>196</td><td>103</td><td>60</td><td>78</td></tr><tr><td>21 (3/4)</td><td>20.9</td><td>344</td><td>181</td><td>106</td><td>137</td></tr><tr><td>27 (1)</td><td>26.6</td><td>557</td><td>294</td><td>172</td><td>222</td></tr><tr><td>35 (1- 1/2)</td><td>35.1</td><td>965</td><td>513</td><td>299</td><td>387</td></tr><tr><td>41 (1-1/2)</td><td>40.9</td><td>1313</td><td>697</td><td>407</td><td>526</td></tr><tr><td colspan="6"></td></tr><tr><td>53(2)</td><td>52.5</td><td>2165</td><td>1149</td><td>671</td><td>867</td></tr><tr><td>63 (2-1/2)</td><td>62.7</td><td>3089</td><td>1638</td><td>956</td><td>1236</td></tr><tr><td>78 (3)</td><td>77.9</td><td>4761</td><td>2523</td><td>1476</td><td>1904</td></tr><tr><td>91 (3-1/2)</td><td>90.1</td><td>6379</td><td>3385</td><td>1977</td><td>2555</td></tr><tr><td>103 (4)</td><td>102.3</td><td>8213</td><td>4349</td><td>2456</td><td>3282</td></tr><tr><td>129 (5)</td><td>128.2</td><td>12907</td><td>6440</td><td>4001</td><td>5163</td></tr><tr><td>155 (6)</td><td>154.1</td><td>18639</td><td>9879</td><td>5778</td><td>7456</td></tr></table>	Nominal size mm	Inner diameter mm	Total interior area mm2	Area available for mm2 conductors			One conductor FR=53%	Two conductors FR=31%	More than two conductors FR = 40%	16 (1/2)	15.8	196	103	60	78	21 (3/4)	20.9	344	181	106	137	27 (1)	26.6	557	294	172	222	35 (1- 1/2)	35.1	965	513	299	387	41 (1-1/2)	40.9	1313	697	407	526							53(2)	52.5	2165	1149	671	867	63 (2-1/2)	62.7	3089	1638	956	1236	78 (3)	77.9	4761	2523	1476	1904	91 (3-1/2)	90.1	6379	3385	1977	2555	103 (4)	102.3	8213	4349	2456	3282	129 (5)	128.2	12907	6440	4001	5163	155 (6)	154.1	18639	9879	5778	7456	
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Quality Inspector	<p>*For flexible metallic or non-metallic conduit and PVC and polyethylene conduit, calculations shall be based on the actual interior dimensions provided by the manufacturer or indicated in the product standard.</p> <p>Note: The nominal size of the tube corresponds to the international standard IEC (International Commission of Electrical Engineering). To familiarize the reader with the international designation, the corresponding designation in inches is indicated in parentheses in the table above.</p>																																																																																								

<p>Quality Inspector</p>	<p>2. CABLE INSTALLATION INSPECTION</p> <p>The inspections must be carried out by the Quality Control Department upon completion of the installation of the cables; they must carry out the following, as well as their registration in the <i>Inspection Record of the installation of power, control, and instrumentation cables (PCC-09/F-01)</i> format:</p> <ol style="list-style-type: none"> 1) Verify that the inspection, measurement, and testing equipment is in perfect condition, both in its physical integrity and in its state of calibration or verification. 2) Verify the caliber of the conductors according to the plans provided by engineering for that project. 3) Verify the type of insulation and wiring path according to the drawings or reference documents. 4) Verify the physical separation of cables by voltage levels following the applicable standards and drawings. 5) Check the cable arrangement. 6) Check the fastening and tightening of the cables to the slats. 7) Verify that the labeling of the circuit is adequate. 8) Perform the cable check at both ends. 9) Check the puncture of the footings. 10) Verify insulation resistance according to specifications, drawings, and reference documents. 11) Perform continuity tests. <p>3. CONTINUITY TEST</p> <p>Continuity is the presence of a complete path for the flow of current. The circuit is complete when the switch is closed. The Continuity Test mode of a digital multimeter can be used to test switches, fuses, electrical connections, conductors, and other components. A good fuse, for example, must have continuity.</p> <p>The digital multimeter emits an audible response (a beep) when it detects an entire path. The beep, an audible indicator, allows technicians to focus on test procedures without having to look at the multimeter's display. When continuity testing is performed, the multimeter beeps based on the resistance of the element being tested. That resistance is determined by the range adjustment of the multimeter. Examples:</p> <ul style="list-style-type: none"> • If the range is set to 400.0 Ω, a multimeter typically beeps if the component has a resistance of 40 Ω or less. • If the range is set to 4000 kΩ, a multimeter typically beeps if the component has a resistance of 200 Ω or less. • The lowest range setting should be used with test circuit components that must have a low resistance value, such as electrical connections or switch contacts. 	<p>Inspection Record of Installation of Power, Control, and Instrumentation Cables (PCC-09/F-01).</p>
<p>Electrical/Electrical Engineer</p>		

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Electrical/Electrical Engineer	<p>The continuity test must be carried out by the Electrical Engineer or the Electrician, while the Quality Control Inspector will witness the test, verifying that the system complies.</p> <p>A. STEPS FOR CONTINUITY TESTING WITH A MULTIMETER</p> <ol style="list-style-type: none"> 1) Turn the switch to Continuity Test mode (). It likely shares a point on the selector with one or more functions, usually the resistor (Ω). With the multimeter probes separated, the display can display OL and Ω. 2) If necessary, press the continue button. 3) First, insert the black test lead into the COM connector. 4) Then, insert the red wire into the V Ω connector. When you're done, remove the wires in the reverse order: first red, then black. 5) With the circuit out of power, connect the test leads through the component you are testing. The position of the test leads is arbitrary. Note that you may need to isolate the component from other components in the circuit. 6) The digital multimeter beeps if a full path (continuity) is detected. If the circuit is open (the switch is in the OFF position), the digital multimeter will not beep. 7) When finished, turn the multimeter to OFF to preserve battery life. <p>This test must be recorded in the <i>Inspection Register of the installation of power, control, and instrumentation cables (PCC-09/F-01)</i>, which must be carried out with each cable. Photographic evidence of continuity tests should also be documented in the same format.</p> <p>4. REJECTED INSPECTIONS OR DEVIATIONS</p> <p>If the inspector detects any deviation or any point of the inspection does not meet the requirements and is rejected, he must make a Statement or a <i>Non-Compliant Exit (PCC-14)</i>, as established in the previous procedure, following up on the repairs or corrections of the deviations found.</p>	<p>Inspection Record of the Installation of Power, Control and Instrumentation Cables (PCC-09/F-01)</p> <p>Non-Compliant Output (PCC-14)</p>
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FORMATS ASSOCIATED WITH THE PROCEDURE			
CODE	REGISTRATION	REVIEW LEVEL	RETENTION TIME
PCC-09/F-01	<i>Inspection Report of Installation of Power Cables, Control and Instrumentation</i>	01	1 year in physical / Digital without expiration