



PROVINCIAL ELECTRICITY AUTHORITY
ELECTRICAL AND MECHANICAL ENGINEERING DIVISION

H - TYPE COMPRESSION TAP CONNECTORS

Specification No.: RCBL-026/2564	Approved date: 24 DEC 2021	Rev. No.: 2	Form No. -	Page 1 of 9
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Invitation to Bid No:

C Material, equipment, and specification for H-TYPE COMPRESSION TAP CONNECTORS

CI General material and packing instructions

Additional to the general instructions, the following shall be observed:

1a Scope

These specifications describe requirements for design, manufacture, tests and supply of H-type compression tap connectors used in low-voltage distribution system.

1b Standards

Except otherwise specified elsewhere in the specification, the connectors shall be manufactured and tested in accordance with the following standards

- ANSI/NEMA CC1-2009 Electric power connection for substations
- ANSI C119.4-2016 Connectors for use between aluminum-to-aluminum and aluminum-to-copper conductors designed for normal operation at or below 93°C and copper-to-copper conductors designed for normal operation at or below 100°C

PEA will also accept connector tested in accordance with the later edition of the above standards.

PEA will also accept the design test report in accordance with the previous edition of the above standards, if there is no significant change in any test items or no additional test item(s) compared with the above standards. On the other hand, if there is significant change in any test items or there are any additional test items, the previous edition design test report with the additional test report(s) of the significant change test item(s) and/or additional test item(s) will be also accepted.

1c Principal requirement

1c.1 Service conditions and installation

The H-type compression tap connector shall be designed and constructed for outdoor installation, and suitable for operation under the following conditions:

- Altitude : up to 1,000 m above sea level
- Ambient air temperature : up to 50°C
- Average relative humidity in any one year : up to 94%
- Climatic condition : tropical climate





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1.c.2 General

The H-type compression tap connectors shall be suitable for connection between LV main aluminium conductor and tap copper conductor which sizes as specified in "C3 Schedule of detailed requirement". The dimensions of the connectors shall be according to Drawing No.SA2-015/25001.

Entire contact surface of the connectors shall be thoroughly filled with oxide inhibiting contact grease, the minimum thickness of the grease shall be 0.5 mm.

Surface of the connectors shall be smooth, consistent, no dirt, no blemishes, no cracks and no rust.

1.c.3 Construction and characteristics

The finished product of the proposed H-type compression tap connector shall be of aluminum grade 1050, 1100 or 1350, which shall be standard grade or designation in accordance with international standards, i.e. SAE, AISI, JIS, ASTM, ANSI, UNS, ISO or BS. It shall be suitable for using with both aluminum to aluminum connection and aluminum to copper connection.

1.c.4 Marking

Each connector shall be marked by mean of engraving, knurling, hot stamping or laser marking on the body at least data listed below, which is clearly visible and durable foil-coated marking, i.e. printing with toner or laser toner with foil-coated. is not accepted.

- (1) Manufacturer's name or Trademark
- (2) Model or catalog/drawing number
- (3) Type and size of conductor to be used with
- (4) Purchase order number

1.c.5 Samples

The bidders shall submit at least one (1) sample for each proposal item within five (5) working days counted from bid closing date for consideration; otherwise, the proposal will be rejected.

PEA's bids committee will initially check the sample by comparing with the color photograph in the proposed type test report and PEA's specification. PEA's bid committee will reject a proposal if there are any parts of sample differing from the color photograph in the type test report and PEA's specification.

PEA reserves the right to test the sample in visual and dimension check and hardness test according to **1e.3 Acceptance tests**, in case of the failing test results. the proposal will be rejected.

The sample will not be returned after consideration, the sample of the successful bidder will be used as a reference sample in acceptance process. The supplied connectors with a different design compared with the reference sample shall be rejected.





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1d Packing

The supplied connectors shall be packed in a seal plastic envelope, by quantity of 1, 5, 10, 20, or appropriate per envelope, for protection the connectors and its compound from dust and moisture.

The envelopes shall be packed in paper box and each paper box shall be marked with purchase order number, contractor's name, manufacturer's name or trademark, model or catalog/drawing number type and size of conductor to be used with, number of connectors in the box and net weight. The box shall be wrapped and sealed with a moisture-proof material.

1e Test and Test report

1e.1 Type tests

The proposed H-type compression tap connector shall be passed all type test items with reference standards and test method as specified in **Table 1**.

Table 1
Type test items of H-type compression tap connector

No.	Test items	Reference standard/Test method	Description
1	Visual and dimension check	PEA's specification	See (1)
2	Chemical composition test	Optical emission spectrometer	See (2)
3	Temperature rise test	ANSI/NEMA CC1	See (3)
4	Conductor damage test	ANSI C119.4	See (4)
5	Hardness test	Brinell hardness test	See (5)





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Before the type tests are proceeded, manufacturer shall submit following detail to PEA for approval:

- Ten (10) samples of H-type compression tap connector (All sample shall be signed by PEA's representative)
- Drawing showing specified dimensions and all information according to Drawing No.SA4-015/25001.
- Standard to be used as a reference of grade or designation of the H-type compression tap connector
- The details of tools and compression dies used for compressing the h-type-compression tap connector shall be submitted as following:
 - The catalogue of tools and compression die which specify the model and the name of manufacturer.
 - The dimensions of compression die are required in case of the manufacturer of h-type-compression tap connector uses his own compression die in the type test processes

One sample of H-type compression tap connector will be kept by PEA (by Electrical Equipment Standard and Quality Control Division) and will be used as a reference sample for bid consideration and acceptance processes.

The other samples will be sent to acknowledged independent testing laboratories/institutes, which have qualification mentioned below, for type tests in accordance with the test items specified in **Table 1**.

(1) Visual and dimension check

Four (4) samples are required for the test. Each sample shall have markings in accordance with clause **1c.4 Marking**, except purchase order number is not required. Dimensions of each sample shall be measured and recorded. The dimensions of all samples shall be according to Drawing No.SA2-015/25001 and according to manufacturer's drawing.

(2) Chemical composition test

One (1) sample is required for the test. The H-type compression tap connector shall be tested by means of optical emission spectrometer for verification grade or designation of aluminium alloy, which shall be aluminium grade or designation specified in accordance with **1.c.3 Construction and characteristics**.

Note: PEA will accept result of the chemical composition test with tolerance of -10% of minimum value of each substance specified in reference standard, except aluminium shall have a minimum value according to the reference standard.





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(3) Temperature rise test

Four (4) samples are required for the test. The temperature rise test shall be according to ANSI/NEMA CC1. Temperature rise of all connectors shall not exceed the temperature rise of tested conductor.

(4) Conductor damage test

Two (2) samples are required for the test. The conductor damage test shall be according to ANSI C119.4.

(5) Hardness test

Two (2) samples are required for the test.

The type tests of the H-type compression tap connectors shall be conducted or inspected by the acknowledged independent testing laboratories/institutes as follows:

(1) Independent at laboratories/institutes which are members of the Short-circuit Testing Liaison (STL) or independent laboratories/institutes which are accredited according to TIS 17025 or ISO/IEC 17025 with the scope of accreditation covered the relevant test items, standard and equipment. The certification and scope of accreditation of the independent laboratories/institutes shall be submitted with the bid for consideration.

(2) Laboratories, institutes, universities and electric utilities, as follows:

- NSTDA Characterization and testing service center (NCTC)
- Thailand Institute of Scientific and Technological Research (TISTR)
- National Metal and Materials Technology Center (MTEC)
- Electrical and Electronic Products Testing Center (PTEC)
- Thai Industrial Standards Institute (TISI)
- Electrical and Electronics Institute (EEI)
- Department of Science Service (DSS)
- Testing Laboratory, Electrical Engineering Department, Faculty of Engineering, Chulalongkorn University
- Electricity Generating Authority of Thailand (EGAT)
- Metropolitan Electricity Authority (MEA)
- Provincial Electricity Authority (PEA)
- Laboratory of manufacturers approved by PEA

(3) Other laboratories as follow:

- In case the foreign manufacturers have experience of more than twenty (20) years in design, manufactures and sell H-type compression tap connector, PEA will accept type test report(s) conducted by the manufacturer's laboratory or other independent laboratories without





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qualification mentioned in (1) or (2). Documents showing the manufacturer's experience such as reference list shall be submitted with the bid for consideration.

- The bidders or manufacturers who prefer to carry out the type tests of H-type compression tap connector with other laboratories without the qualification mentioned above, the detail of laboratory and the test facilities shall be submitted to PEA for approval before proceeding the tests and before the bid closing date. PEA reserves the right to send representatives to inspect or witness the tests.

The type test reports conducted by the laboratories/institutes in Thailand or local manufacturers shall be valid within five (5) years counted from the issued date in the test report to the bid closing date. The type test reports conducted by the laboratories/institutes in other countries shall be valid within ten (10) years counted from the issued date in the test report to the bid closing date.

The cost of all tests and report shall be borne by the Bidders or manufacturers.

The type test reports shall be submitted with the bid.

PEA will also accept other documents instead of the type test reports in the following cases:

- (1) In case the proposed connectors have been sold to PEA at PEA's Procurement Department (from PEA's head office). The bidder can submit the Purchase Order (PO) on the bid closing date, or
- (2) In case the proposed connectors have been registered for PEA Product Acceptance⁽¹⁾, the Bidder can submit the valid registration certificate on the bid closing date, or
- (3) In case the proposed connectors have been registered for Product lists for transmission and substation turnkey project⁽²⁾, the Bidder can submit the valid registration certificate on the bid closing date.

However the document in case (1), (2) and (3) mentioned above shall be proved by the bidding committee that connectors specified in the PO or registration certificate is the same product, type model and all ratings as the proposed connectors for this bid.

Note: ⁽¹⁾ PEA Product Acceptance (PPA) is the process for enhancing quality of electrical apparatus which PEA procure by making quality control system and certification of product's quality by reliable Certification Body (CB). PPA is taken responsibility by Electrical Equipment Standard and Quality Control Division.

⁽²⁾ Product lists for transmission and substation turnkey project is the process of registration of electrical apparatus used in PEA's power system. Product lists is taken responsibility by Substation Project Management Division.

The type test reports shall consist of the necessary as follow; otherwise, it is not accepted by PEA

- (1) The test results of all test items as specified in **Table 1**.
- (2) The details of tools and compression dies used for compressing the H-type compression tap connector in the type test processes shall be declared as following:





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- Catalogue of tools and compression die which specify the model and the name of manufacturer, or
 - Dimensions of compression die are required in case of the manufacturer of the connectors uses his own compression die in the type test processes.
- (3) Outline drawing of the H-type compression tap connector, showing dimensions according to Drawing No.SA2-015/25001
- (4) The color photographs of H-type compression tap connector as following:
- Manufacturer's name or Trademark
 - Size of conductor to be used with
 - Model or catalog/drawing number H-type compression tap connector
 - Oxide inhibiting contact grease

1.e.2 Routine tests

Each H-type compression tap connector shall pass visual and dimension check and other tests according to manufacturer's standard.

1e.3 Acceptance tests

PEA reserves the right to have acceptance tests, conducted by PEA's laboratory or acknowledge independent testing laboratories as mentioned in 1e.1 or by manufacturer's factory qualified by PEA.

The cost of all tests shall be borne by the Contractor.

PEA's acceptance committee will randomly select the samples of connector for each delivery lot with the number as specified in **Table 2**.

Table 2
Number of samples for acceptance tests

Number of H-type compression tap connector for each delivery lot (sets)	Number of samples (sets)
Up to 100	2
101 – 500	3
501 – 1,000	4
More than 1,000	5

- Note:**
- The samples shall not be returned and shall not be used in the system.
 - After the tests, the additional H-type compression tap connectors, with the equal number of the samples specified in **Table 2**, shall be supplied by the contractor with free of charge to complete the number of connectors in the purchase contract.





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All sample(s) shall pass acceptance test items No. 1 – 5 sequentially, with reference standards and test method as specified in **Table 3**. PEA reserve the right not to continue the tests if the sample is failed the test in any test items.

Table 3
Acceptance test items of H-Type compression tap connectors

No	Test Items	Reference standard /Test method	Acceptance criteria
1	Visual check	PEA's specification	<ul style="list-style-type: none"> - Surface of all samples shall be smooth, consistent, no dirt, no blemishes, no cracks and no rust - All sample shall have markings in accordance with clause 1c.4 Marking - Entire contact surface of all samples shall be thoroughly filled with oxide inhibiting contact grease, the minimum thickness of the grease shall be 0.5 mm
2	Dimension check	PEA's specification	Dimension of all sample shall be according to manufacturer's drawing and shall be according to Drawing No. SA2-015/25001
3	Chemical composition test	Optical emission spectrometer	According to Chemical composition test specified in Table 1 . Note: Testing only one (1) sample per lot
4	Hardness test	Brinell hardness test	The test result shall be within 10% tolerance of the hardness test result in the type test report. Note: Testing only one (1) sample per lot
5	Assembly test	PEA's specification	The samples shall be suitable to assemble with the conductor to be used with.





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C2 Material and packing data shall be submitted with the bid:

The following critical documents and details shall be submitted with the bid:

Critical documents of the proposed h-type compression tap connector shall be submitted with the bid for each item offered:

(The bidders shall fill the table below; otherwise, the proposal shall be rejected)

No.	Required technical document	Proposed Technical document	Reference document (Page No.)
1	Type test report (see 1e.1) or	<input type="checkbox"/> YES <input type="checkbox"/> No	
	Purchase Order (PO) from PEA's Procurement Department (from PEA's head office) (see 1e.1) or	<input type="checkbox"/> YES <input type="checkbox"/> No	
	Product acceptance certificate (see 1e.1)	<input type="checkbox"/> YES <input type="checkbox"/> No	
	Product lists certificate (see 1e.1)	<input type="checkbox"/> YES <input type="checkbox"/> No	
2	Drawing(s) of the proposed H-type compression tap connectors, showing dimensions (see 1c.2) (Drawing(s) by using PEA's drawings shall not be accepted)	<input type="checkbox"/> YES <input type="checkbox"/> No	
3	Packing detail (see 1d)	<input type="checkbox"/> YES <input type="checkbox"/> No	





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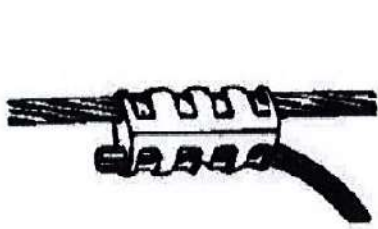
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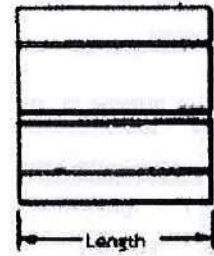
C3 Schedule of detailed requirement

Invitation to Bid No.: S1(B)HDW2(H)14/2567

Item	PEA Material No.	Quantity	Description
2	1020320009	50,400 pc(s)	<p>Connector, compression tap, H-type, connection of main aluminium conductor to tap copper conductor and main aluminium conductor to tap aluminium conductor, see Drawing No. SA2-015/25001, with :</p> <p>Main : diameter range of 3.57 mm to 4.50 mm (size 10 mm² to 16 mm²)</p> <p>Tap : diameter range of 2.25 mm to 3.57 mm (size 4 mm² to 10 mm²)</p> <p>Minimum Length : 25 mm</p>
			<p><u>Note</u> :</p> <p>Enclosed Drawing No. SA2-015/25001.</p>



Cross section



Side view

PEA MATERIAL No.	CONDUCTOR RANGE		MINIMUM LENGTH (mm)	SIMILAR TO							
	MAIN SIZES (mm)	TAP SIZES (mm)		BURNDY		KEARNEY		HOMAC		PENN-UNION	
				CATALOGUE NO.	DIE INDEX	CATALOGUE NO.	DIE INDEX	CATALOGUE NO.	DIE INDEX	CATALOGUE NO.	DIE INDEX
1020320009	10-16	4-10	25	YPC2A8U	BG	421-82	5/8"	UB 214	5/8"	-	-
1020320010	25-50	2.5-6	30	-	-	424-82	0	OB 2014	0	KO-R24	0
1020320011	25-50	16-35	40	YHO-150	0	508-82	0	OB 103	0	KO-R06	0
1020320012	50-95	50-95	55	YHD-300	D3	504-82	0	DB 2020	D	KD-R04	D
1020320013	70-95	16-35	40	YHD-200	D3	502-82	0	DB 202	0	KD-R02	D
1020320014	35-50	6-10	30	YPC26R8U	0	428-82	0	-	-	KO-R24	0
1020320015	70-95	6-10	30	YPC26R8U	0	-	-	-	-	-	-

กองวิศวกรรมไฟฟ้าและเครื่องกล ฝ่ายวิศวกรรม การไฟฟ้าส่วนภูมิภาค

มิติเป็น วันที่ 13 ธ.ค. 2564	H-TYPE COMPRESSION TAP CONNECTORS	แบบเลขที่ SA2-015/25001 Issued by SmartSpec Date: 13/12/23 แผ่นที่ ของจำนวนหน้า แผ่น
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PROVINCIAL ELECTRICITY AUTHORITY

TECHNICAL SPECIFICATION DIVISION

COPY

HOTLINE CLAMPS

Specification No.: RHOT-081/2561

Approved date: **1.3 JUN 2018**

Rev. No.: 2

Form No. 12-1

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Invitation to Bid No.:

C Material, equipment, and specifications for HOTLINE CLAMPS

CI General material and packing instructions

Additional to the general instructions, the following shall be observed:

1a Scope

These specifications cover hotline clamps; i.e., protected thread clamps and bail clamps for connection of bare aluminium stranded conductor, aluminium-alloy stranded conductor and aluminium conductor steel reinforced.

1b Standards

Except otherwise specified elsewhere in the specification, hotline clamps shall be manufactured and tested in accordance with the standards listed below.

American National Standards Institute (ANSI):

ANSI C119.4: 2016 Electric connectors – Connectors for use between Aluminum-to-Aluminum and Aluminum-to-Copper Conductors Designed for Normal Operation at or Below 93°C and Copper-to-Copper Conductors Designed for normal Operation at or Below 100°C

PEA will also accept hotline clamps tested in accordance with the later edition of the above standards.

PEA will also accept the Design test report in accordance with the previous edition of the above standards, if there is no significant change in any test items or no additional test item(s) compared with the above standards. On the other hand, if there is significant change in any test items or there are any additional test items, the previous edition Design test report with the additional test report(s) of the significant change test item(s) and/or additional test item(s) will be also accepted.

1c Principal requirement

The contact surface of the hotline clamps shall be thoroughly filled with conduction aid oxide inhibiting compound prevents water and contaminants interfering with the connection, prevents the formation of surface oxide and decreases electrical resistance in the connection area. The minimum thickness of conduction aid oxide inhibiting compound in the connection area shall be 0.5 mm.





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BID No. ST(B)HDW2(H)14/2567

HOTLINE CLAMPS

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1c.1 Hotline protected thread clamp

The hotline protected thread clamp shall be suitable for using with bail (in plated hard draw copper) of hotline bail clamp.

Hotline protected thread clamp shall be suitable for using with clampstick according to standard ASTM F1825-03.

Dimension of the hotline protected thread clamp shall be according to Figure 1.

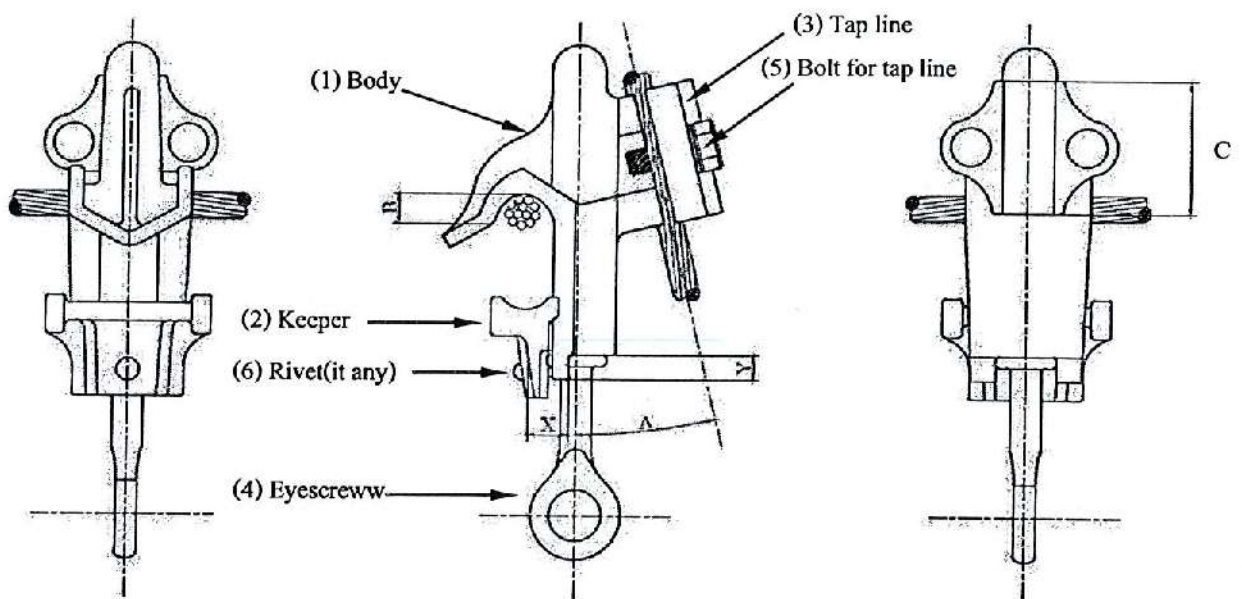


Figure 1

Note:

- Dimension of clamp base (clamp base shall be able to align into notch of clampstick)
 - Max, width (X) 12.2 mm
 - Min, depth (Y) 7.6 mm
- Dimension of body
 - Min, depth (B) 14 mm
 - Min, length (C) 45 mm
- Dimension of tap line shall have the same minimum length (C) 45 mm of the body
- Angle between body and tap line
 - The angle (A) shall be between 20 and 30 degrees according to Figure 1.
- Eyescrew size of hotline protected clamp shall not less than 7/16 inch and withstand tightening torque of at least 240 lbf·in.
- Bolt(s) for tap line of hotline protected clamp shall not less than 7/16 inch and withstand tightening torque of at least 240 lbf·in.





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Hotline protected thread clamp shall be made of material as following:

- (1) Body – Aluminum alloy (with chemical composition (%) of aluminium not less than 90%)
- (2) Keeper – Aluminum alloy (with chemical composition (%) of aluminium not less than 90%)
- (3) Tap line – Aluminum alloy (with chemical composition (%) of aluminium not less than 90%)
- (4) Eyescrew – Bronze
- (5) Bolt(s) for tap line – Stainless steel (grade 304)
- (6) Rivet of keeper (if any); for stopping Eyescrew – Stainless steel (grade 304)
- (7) Spring washer(s) (on Eyescrew & Tap line) – Stainless steel (grade 304)

The chemical compositions of body, keeper, tap line and eyescrew shall also be in accordance with standards as following: SAE, AISI, JIS, ASTM or others approved by PEA.

1c.2 Hotline bail clamp

The hotline bail clamp shall be suitable for using with PEA’s installed aluminum conductor and shall have diameter ranges as specified in **Table 1**.

Hotline bail clamp shall be suitable for using with clampstick according to standard ASTM F1825-03.

Dimension of the hotline bail clamp shall be according to **Figure 2**.

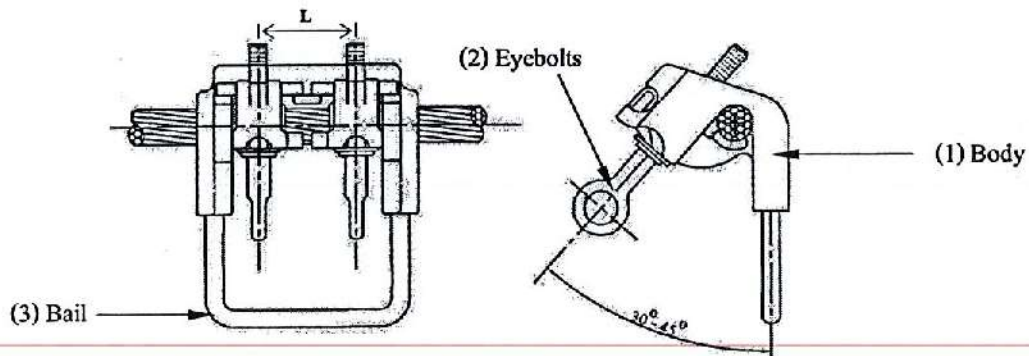


Figure 2

Note:

- The length (L) of **Figure 2** shall not be less than 44 mm.
- The hotline bail clamp shall be suitable for used on hotline operation by means of spring load Eyescrews. Angle between Bail and Eyebolts shall be between 30 and 45 degree according to **Figure 2**.
- The design of hotline bail clamp as shown in **Figure 3** is not accepted.





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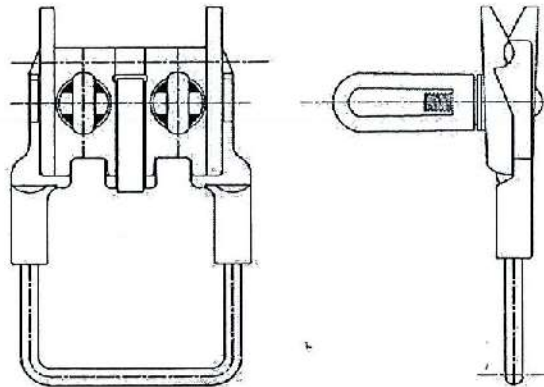


Figure 3

The hotline bail clamp shall be made of material as following:

- (1) Body – Aluminium-alloy (with chemical composition (%) of aluminium not less than 90%)
- (2) Eyebolt(s) – Bronze
- (3) Bail – Tin plated hard drawn copper (with chemical composition (%) of copper not less than 99%)
- (4) Spring washer(s) on Eyescrews – Stainless steel (304 grade)
- (5) Spring load(s) – Stainless steel (304 grade)

The chemical compositions of Body and eyebolt(s) shall also be in accordance with standards as following: SAE, AISI, JIS, ASTM or others approved by PEA.

Table 1
Items of hotline bail clamp

Item	Main line	Bail diameter	Eyebolt size	Minimum Tightening torque
1	diameter range of 6.6 mm to 10.2 mm (sizes 35 mm ² to 70 mm ²)	not less than 8.5 mm	7/16 inch	240 lbf•in (27 N•m)
2	diameter range of 9.3 mm to 19 mm (sizes 70 mm ² to 185 mm ²)	not less than 8.5 mm	7/16 inch or 1/2 inch	240 lbf•in (27 N•m) 300 lbf•in (34 N•m)

1c.3 Marking

Each hotline clamps shall be marked by mean of emboss on the body at least listed below. Except purchase order number may be marked by means of engraving, stamping or laser marking.

- (1) Manufacturer's name or Trademark
- (2) Conductor tap and size to be used (the marking shall be of metric system)
- (3) Catalog number of the connector
- (4) Purchase order number





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1c.4 Sample

The bidders shall submitted at least one (1) sample for each proposal item within five (5) working days counted from bid closing date for consideration; otherwise, the proposal shall be rejected. PEA's Bids committee will initially check the material, conduction aid oxide inhibiting compound filling on the contact surface of the hotline clamps and others by comparing with the color photograph of the Design test report and PEA's specification. PEA's committee shall reject a proposal if there are any parts of hotline clamp differing from the color photograph of Design test report and PEA's specification. The sample shall not be returned. The sample of the successful bidder will be used as a reference sample in acceptance process. The supplied hotline clamp with a difference material or design compared with the reference sample shall be rejected.

1d Packing

Each hotline clamps shall be supplied in individually sealed package.

The packages shall be packed in suitable carton. Each carton shall be marked with lots number and date of manufacturing; date, month and year. The carton shall contain hotline clamps not more than twenty-five (25) pieces.

If there are many cartons for containerized shipment, the cartons shall be arranged into pallets so as to facilitate their movement by forklift trucks.

1e Tests and test report

1e.1 Design tests

The proposed hotline clamps shall be passed the Design tests as follow:

- Current Cycle Test (CCT) (class A) or Current Cycle Submersion Test (CCST) (Class A)
- Torque strength test

Unless otherwise specified in this specification, both Current Cycle Test (CCT) (class A) or Current Cycle Submersion Test (CCST) (Class A) and torque strength test shall be complied with ANSI C119.4: 2016 or later edition with the additional requirement as follow:

(1) Additional requirement for Current Cycle Test (CCT) and Current Cycle Submersion Test (CCST):

Loop of Current Cycle Test (CCT) (class A) or Current Cycle Submersion Test (CCST) (Class A) shall test with Four (4) sets of hotline clamps. (Each set consisted of hotline bail clamp installed with hotline protected thread clamp)

Temperature measurements shall be measured at least for eight (8) points of the connector. four (4) points shall be measured at hotline bail clamps and others shall be measured at hotline protected thread clamp.

The conductor used in the process of current cycle test shall be aluminium stranded conductor.





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(2) Additional requirement for torque strength test

(2.1) Hotline protected thread clamp

- Torque the fastener to the value specified in 1c.1.
- Hotline protected thread clamp shall be tested with bail of hotline bail clamp for run and 50 mm² and 185 mm² aluminium stranded conductor for tap.

(2.2) Hotline bail clamp

- Torque the fastener to the value specified in Table 1.
- Hotline bail clamp (sizes 35 mm² to 70 mm²) shall be tested with 35 and 70 mm² conductor for run
- Hotline bail clamp (sizes 70 mm² to 185 mm²) shall be tested with 70 and 185 mm² conductor for run

The cable used in the process of torque strength test shall be aluminium stranded conductor.

The Design test report shall include the necessary data as specified in ANSI C119.4-2016, or later edition, recommendation - Test Report and PEA's additional requirement as follow:

- Description documents of hotline clamps according to manufacturer's data
 - Catalog of hotline clamps consisting of at least brand name and type/model of the product
 - Detailed outline drawing of hotline clamps with the data as specified in 2d (see page 13)
 - Test reports of grade and chemical composition of each part of the hotline clamps as specified in Table 2, which shall be in accordance with standards as following: SAE, AISI, JIS, ASTM or others approved by PEA. The certificates of grade of material from material supplier are accepted in this specification. Except body, keeper and tap line, the test reports of grade and chemical composition are required.

Table 2

Each part of Hotline clamp

Hotline protected thread clamp	Hotline bail clamp
Body and keeper	Body
Tap line	Eyebolt(s)
Eyscrew	Bail
Bolt(s) for tap line	Spring washer(s)
Spring washer(s)	Spring load(s)
Rivet of keeper (if any)	

- Brand name, Type or model, Manufacturer and properties of conduction aid oxide inhibiting compound filled in the contact surface of hotline clamps.





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- Certificate of conduction aid oxide inhibiting compound, for proving the properties that it is suitable for using with a bolted connector and have the properties as required in this specification (see 1c). The certificate is required only when the bidder mix the material of conduction aid oxide inhibiting compound by himself.
- The color photograph of each part of hotline clamps as specified in Table 2 and others as following:
 - Manufacturer's name or Trademark
 - Conductor tap and size to be used
 - Catalog number of the connector
 - Conduction aid oxide inhibiting compound filled in the contact surface of hotline clamps
- Net weight of each hotline clamps

The additional conditions for the Design test report tested by laboratories in Thailand

The Design test report shall be completed only when there is signature of PEA's representative, from Electrical Equipment Standard and Quality Control Division and/or Technical Specification Division, on all pages of the Design test report.

In the Current Cycle Test (CCT) (class A) or Current Cycle Submersion Test (CCST) (Class A) process, PEA reserves the right to send PEA's representative by PEA's expense to witness the process of collecting the data of current cycle resistance stability and current cycle temperature stability at least (3) three data point number at the measurement intervals as specified in Table 3.

Table 3

Data point number for measurement intervals

Data point number	Cycles of CCT	Cycles of CCST
1	(25 – 30 cycles)	(5 – 7 cycles)
6	(160 – 170 cycles)	(57 – 61 cycles)
11	(495 – 505 cycles)	(98 – 102 cycles)

At data point number 1, PEA's representative reserve the right to sign the signature on test objects with permanent marker pen as an indicator.





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The Design tests of hotline clamps shall be conducted or inspected by the acknowledged independent testing laboratories/institutes as follows:

- (1) Independent laboratories/institutes which are members of the Short-circuit Testing Liaison (STL) or independent laboratories/institutes which are accredited according to TIS 17025 or ISO/IEC 17025 with the scope of accreditation covered the relevant test items, standards and equipment. The certification and scope of accreditation of the independent laboratories/institutes shall be submitted with the bid for consideration.
- (2) Laboratories, institutes, universities and electric utilities, as follows:
 - National Metal and Materials Technology Center (MTEC)
 - Electrical and Electronic Products Testing Center (PTEC)
 - Thai Industrial Standards Institute (TISI)
 - Electrical and Electronics Institute (EEI)
 - Department of Science Service (DSS)
 - Testing Laboratory, Electrical Engineering Department, Faculty of Engineering, Chulalongkorn University
 - Electricity Generating Authority of Thailand (EGAT)
 - Metropolitan Electricity Authority (MEA)
 - Provincial Electricity Authority (PEA)
 - Other laboratories, institutes, universities or electric utilities approved by PEA

The Design test report done by the laboratories in Thailand or local manufacturers shall be valid with five (5) years counted from the issued date in the test report to the bid closing date.

The Design test report of the proposed hotline clamps shall be submitted with the bid. The report will be sent to Engineering Department for approving.

PEA will also accept other documents instead of the Design test reports in the following conditions:

- (1) In case the proposed hotline clamps has been supplied to PEA and get the order from PEA's Procurement Department (from PEA's head office), the Purchase Order (PO) can be submitted, or
- (2) In case the proposed hotline clamps has been registered for PEA Product Acceptance, the not-expired registration certificate counted to the bid closing date can be submitted, or
- (3) In case the proposed hotline clamps has been registered for Product lists for substation turnkey project, the not-expired registration certificate counted to the bid closing date can be submitted instead

However the document in case (1) and (2) shall be proved that the hotline clamps specified in the PO or registration certificate shall be the same product, type/model and all ratings as the proposed hotline clamps for this bid and shall be used the same PEA's specification number. In case (3), the hotline clamps specified in the registration certificate shall be the same product, type/model and all ratings as the proposed hotline clamps for this bid.



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1c.2 Acceptance tests

1c.2.1 Acceptance test procedures

PEA reserves the right to have an acceptance test made by PEA's laboratory or by supplier's factory or by acknowledge independent testing laboratories as mentioned in 1e.1.

The cost of all tests and report shall be borne by the Contractor.

(1) Number of sample

PEA shall randomly choose the sample of hotline clamps per lot with the number specified in Table 4.

Table 4
Number of sample

Number of item per lot	Number of sample for acceptance test	Test items (see Table 5 and Table 6)
not more than 50	2	Step 1 and Step 2
51 to 100	4	
more than 100	10	Step 1 and Step 2 and Step 3

- Note:**
- The sample shall not be returned and shall not be used in the system.
 - After the tests, the additional hotline clamps, with the equal number of the samples specified in Table 4, shall be supplied by the Contractor with free of charge to complete the number of hotline clamp in the purchase contract.

PEA will test the hotline clamps step by step as the sequence of testing specified in Table 5 and Table 6, In case hotline clamps fails the test at least 1 (one) sample in any step of the test sequence, PEA shall not continue the test in the next step and reject all items in the lot.

The number of sample for acceptance test which are not more than (4) four items shall be tested by the sequence of testing at least for step 1 and step 2 according to Table 5 and Table 6.

The number of sample for acceptance test having (10) ten units shall be tested by all sequence of testing for step 1, step 2 and step 3 according to Table 5 and Table 6; (6) six units for torque strength test, (4) units for temperature rise test.





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(2) Hotline protected thread clamp

The acceptance test process of hotline protected thread clamp shall be according to Table 5.

Table 5

Acceptance test for hotline protected thread clamp

Sequence of testing	Test Item	Test method	Condition
Step 1	Visual check	PEA's procedure	The materials of hotline clamps shall not differ from PEA's specification and the Design test report.
Step 2	Torque strength test ⁽¹⁾	Torque the fastener to the value specified in 1c.1	All connectors do not show any sign of crack.
Step 3	Temperature rise test ⁽²⁾	NEMA CC1-2009 clause 2.6 and 3.1	Temperature rise of all connectors shall not exceed the temperature rise of tested conductor and current values to be used in the temperature rise tests shall be accordance with Table B-3 for outdoor connector type.

Remark

- (1) Test sample units shall be tested with hotline bail clamp for run and 185 mm² compact stranded aluminium conductor for tap.
- (2) The cable used in the temperature rise test shall be new compact stranded aluminium conductor.

(3) Hotline bail clamp

The acceptance test process of hotline bail clamp shall be according to Table 6.

Table 6

Acceptance test for hotline bail clamp

Sequence of testing	Test Item	Test method	Condition
Step 1	Visual check	PEA's procedure	The materials of hotline clamps shall not differ from PEA's specification and the Design test report.
Step 2	Torque strength test ⁽³⁾	Torque the fastener to the value specified in Table 1	All connectors do not show any sign of crack.
Step 3	Temperature rise test ⁽⁴⁾	NEMA CC1-2009 clause 2.6 and 3.1	Temperature rise of all connectors shall not exceed the temperature rise of tested conductor and current values to be used in the temperature rise tests shall be accordance with Table B-3 for outdoor connector type.





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Remark

(3) Test samples units shall be tested with conductor size as follow:

- For hotline bail clamp (sizes 35 mm² to 70 mm²); Test samples shall be tested with 70 mm² (if any) or 50 mm² compact stranded aluminium conductor for run
- For hotline bail clamp (sizes 70 mm² to 185 mm²); Test samples shall be tested with 185 mm² compact stranded aluminium conductor for run

(4) The cable used in the temperature rise test shall be as follow:

- For hotline bail clamp (sizes 35 mm² to 70 mm²); Size of cable in the test loop shall be 70 mm² (if any) or 50 mm² compact stranded aluminium conductor.
- For hotline bail clamp (sizes 70 mm² to 185 mm²); Size of cable in the test loop shall be 185 mm² compact stranded aluminium conductor.

The cable used in the temperature rise test shall be new compact stranded aluminium conductor.

1c.2.2 Special acceptance test

PEA reserve the right to inspect the chemical compositions of each part of hotline clamps at any time he deems necessary by PEA's expense for proving the materials of hotline clamps that they are the same as shown in the Design test report.

If the materials of hotline clamps differ from the data showed in the Design test report, PEA shall reject all items in the lot.

If Manufacturing process inspection

PEA reserves the right to send the representatives by PEA's expense to inspect material, equipment, manufacturing process of the products during manufacturing with free access any time he deems necessary as follow:

- casting process
- assembly line process

The Contractor shall provide free access to the facilities where the hotline clamps are being manufactured, explain representatives about the quality assurance plan and quality control (QA & QC) of the factory and satisfy the representatives that materials used to make hotline clamps are in accordance with PEA's specification and show the suppliers list from whom you purchase materials to PEA's representatives; otherwise, the contract shall be rejected.

The documents as following shall be submitted with the bid

- Quality assurance plan in production line (QA)
- Quality control at the end of assembly line (QC)
- Material inspection process
- Production flow chart

The Contractor shall inform PEA in advance about date of manufacturing in order that PEA can make an appointment with the Contractor for inspecting the process as above-mention.





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1g Guarantee

The Contractor who offer the hotline clamps shall guarantee the quality for two (2) years commencing from the date PEA receive the above-mentioned hotline clamps in the last lot in the condition as specified in note below.

Note:

ภายในกำหนดระยะเวลารับประกันคุณภาพ หากการไฟฟ้าส่วนภูมิกานำ Hotline clamps ไปใช้งานตามปกติแล้วปรากฏว่า ชำรุด ชัดข้อง หรือบกพร่อง คู่สัญญาจะต้องนำ Hotline clamps ตัวใหม่มาเปลี่ยนทดแทนของที่ชำรุด ภายใน 60 วัน นับถัดจากวันที่ได้รับแจ้งจากการไฟฟ้าส่วนภูมิภาค และหากการชำรุด ชัดข้อง หรือบกพร่องดังกล่าว มีสาเหตุมาจากคุณสมบัติที่ไม่เป็นไปตามสเปคของการไฟฟ้าส่วนภูมิภาค คู่สัญญาจะต้องเปลี่ยนสิ่งของที่ส่งมอบตามสัญญาทั้งหมดให้แก่การไฟฟ้าส่วนภูมิภาค โดยไม่คิดค่าใช้จ่ายใดๆ ทั้งสิ้น และในกรณีการชำรุด ชัดข้อง หรือบกพร่องดังกล่าว เกิดขึ้นกับ Hotline clamps ที่ได้ถูกติดตั้งใช้งานแล้ว คู่สัญญาจะต้องยินยอมชดเชยค่าใช้จ่ายให้แก่การไฟฟ้าส่วนภูมิภาค ในการดำเนินการรื้อถอนและติดตั้ง Hotline clamps ใหม่ โดยมีค่าใช้จ่ายชุดละ 2,000 บาท พร้อมทั้งยินยอมรับผิดชอบค่าเสียหายอื่นที่อาจเกิดขึ้นอันสืบเนื่องมาจาก การชำรุด ชัดข้อง หรือบกพร่อง และคู่สัญญาจะต้องรับประกันคุณภาพ Hotline clamps ตัวใหม่ที่นำมาเปลี่ยนทดแทนของที่ชำรุดเป็นระยะเวลา 2 ปี นับจากวันที่การไฟฟ้าส่วนภูมิภาคได้ทำการตรวจรับ Hotline clamps ที่คู่สัญญานำมาเปลี่ยนให้ใหม่เสร็จเรียบร้อยแล้ว และในกรณีที่คู่สัญญาต้องเปลี่ยนทดแทน Hotline clamps ที่ส่งมอบตามสัญญาทั้งหมดให้แก่การไฟฟ้าส่วนภูมิภาค Hotline clamps เหล่านี้ต้องผ่านกระบวนการทดสอบเพื่อการตรวจรับตามหัวข้อ 1e.2 ด้วย

Hotline clamps ตัวใหม่ที่คู่สัญญานำมาทดแทนจะต้องทำเครื่องหมาย (Marking) ตามที่ระบุไว้ในสเปคฯ หัวข้อ 1c.3 และจะต้องทำเครื่องหมายตัวอักษร "R" (หมายถึงสิ่งของเพื่อทดแทนของที่ชำรุด) เพิ่มเติมต่อท้ายเลข PO (Purchase order number) ด้วย โดยวิธีการตามที่ระบุไว้ในหัวข้อ 1c.3





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C2 Material and packing data shall be submitted with the bid:

2a Design test report

Photographs in the Design test report shall be in color.

2b Performance data and guarantee of hotline clamps (see page 14 of 17 to 15 of 17)

2c Catalog of the proposed hotline clamps

2d Detailed outline drawing of hotline clamps with dimension

- The bidder shall submitted company's outline drawing.
- Outline drawing of PEA's specification is not accepted

Detailed outline drawing of hotline clamps shall consist of the data as follow:

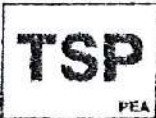
- For hotline protected thread clamp
 - Dimension of clamp base (X & Y) in metric system as shown in **Figure 1**
 - Dimension of body (B & C) in metric system as shown in **Figure 1**
 - Dimension of tap line in metric system
 - Angle between body and tap line
 - Size of eyescrew to be used (inch)
 - Size of bolt(s) for tap line to be used (inch)
 - Maximum torque (lbf•in)
- For hotline bail clamp
 - Length (L) in metric system as shown in **Figure 2**
 - Angle between bail and eyebolt
 - Size of eyebolt(s) to be used (inch)
 - Maximum torque (lbf•in)

2e Detailed conduction aid oxide inhibiting compound (or Certificate of conduction aid oxide inhibiting compound in case the bidder mixes the materials by himself)

- Brand name
- Type or model
- Manufacturer
- Property

2f The quality assurance plan and quality control (QA & QC) and others as following

- Quality assurance plan in production line (QA)
- Quality control at the end of assembly line (QC)
- Material inspection process
- Production flow chart



2g Certificate of the company from which the Contractor casts hotline clamps (see page 17 of 17)

2h Packing detail



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Invitation to Bid No:

Performance data and guarantee of hotline protected thread clamp

Item

Country of origin		
Type or model		
Manufacturers or Distributor		
Applied standard		
Date of manufacturing		
PO (Purchase order number)		
Brand name		
Manufacturer name	-	
Catalog number (to be attached)	-	
Outline drawing number (to be attached)	-	
Diameter range of conductor		
- Main	mm ²	
- Tap	mm ²	
Material to be used (for hotline protected thread clamp)		
- Body	-	
- Keeper	-	
- Tap line	-	
- Eyescrew	-	
- Bolt(s) for tap line	-	
- Spring washer(s)	-	
- Rivet of keeper (if any)	-	
Bolt size of fastener		
- Eyescrew	inch	
- Bolt(s) for tap line	inch	
Length of rivet	mm	
Confirm to be filled with conduction aid oxide inhibiting compound	Yes/No	
Confirm to be packed in individually sealed package	Yes/No	
Type of coil lock washer (double coil lock washer or single coil lock washer)	-	
Marking (to be specified)	-	
Net weight per each	g	
Gross weight per carton	kg	
Guarantee period	year(s)	





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Invitation to Bid No:

Performance data and guarantee of hotline bail clamp

Item

Country of origin		
Type or model		
Catalog number		
Manufacturers or Distributor		
Applied standard		
Date of manufacturing		
PO (Purchase order number)		
Brand name		
Diameter range of conductor		
- Main	mm ²	
- Tap	mm ²	
Material to be used (for hotline bail clamp)		
- Body	-	
- Eyebolts	-	
- Bail	-	
- Spring washer(s)	-	
- Spring load(s)	-	
Bolt size of fastener		
- Eyebolt(s)	inch	
Bail size	mm	
Confirm to be filled with conduction aid oxide inhibiting compound (Yes or No)	Yes/No	
Confirm to be packed in individually sealed package (Yes or No)	Yes/No	
Type of coil lock washer (double coil lock washer or single coil lock washer)	-	
Marking (to be specified)	-	
Net weight per each	g	
Gross weight per carton	kg	
Guarantee period	year(s)	





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Required document of technical evaluation

Critical documents shall be submitted with the bid

(Please fill/check the boxes in each item)

No.	Required technical document	Proposed technical document	Reference document (Page No.)
1	- Design test report (see 1e.1) or - Purchase Order (PO) (see 1e.1) or - Product acceptance certificate (see 1e.1) - Product lists certificate (see 1e.1)	<input type="checkbox"/> YES <input type="checkbox"/> No	
2	Performance data and guarantee of hotline clamps (see 2b)	<input type="checkbox"/> YES <input type="checkbox"/> No	
3	Catalog of hotline clamps (see 2c)	<input type="checkbox"/> YES <input type="checkbox"/> No	
4	Detailed outline drawing of hotline clamps with dimension (see 2d)	<input type="checkbox"/> YES <input type="checkbox"/> No	
5	Detailed conduction aid oxide inhibiting compound (or Certificate of conduction aid oxide inhibiting compound) (see 2e)	<input type="checkbox"/> YES <input type="checkbox"/> No	
6	- Quality assurance plan in production line (QA) - Quality control at the end of assembly line (QC) - Material inspection process - Production flow chart (see 2f)	<input type="checkbox"/> YES <input type="checkbox"/> No	
7	Certificate of the company from which the Contractor casts hotline clamps(see 2g)	<input type="checkbox"/> YES <input type="checkbox"/> No	
8	Packing detail (see 2h)	<input type="checkbox"/> YES <input type="checkbox"/> No	

Note:

Critical documents shall be submitted with the bid; otherwise, the proposal shall be rejected.



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ภาคผนวก

แบบฟอร์มรับรองการหล่อชิ้นงานของโรงงานที่ทำการหล่อชิ้นงาน
(ต้องส่งแบบฟอร์มรับรองการหล่อชิ้นงานในวันขึ้นของประกวดราคา)

วันที่.....เดือน.....พ.ศ.....

ข้าพเจ้า (บริษัท, โรงงาน).....
สำนักงานตั้งอยู่เลขที่..... หมู่..... ซอย..... ถนน..... ตำบล/แขวง.....
อำเภอ/เขต..... จังหวัด..... หมายเลขโทรศัพท์.....
ขอรับรองว่าเป็นผู้หล่อตัวอย่างชิ้นงานให้แก่ (บริษัท, ห้าง, ร้าน).....
เพื่อนำมาเสนอในการประกวดราคา เลขที่.....ของการไฟฟ้าส่วนภูมิภาคต่อไป

ลงชื่อ.....

(.....)

ประทับตราบริษัท, โรงงาน





PROVINCIAL ELECTRICITY AUTHORITY
ELECTRICAL AND MECHANICAL ENGINEERING DIVISION

Specification No.: RHOT-081/2561
HOTLINE CLAMPS

Page 1 of 1

C3 Schedule of detailed requirement

Invitation to Bid No.: S1(B)HDW2(H)14/2567

Item	PEA Material No.	Quantity	Description
3	1020330005	1,600 EA	Hotline bail clamp, with: Main line : diameter range of 6.6 mm to 10.2 mm (sizes 35 mm ² to 70 mm ²) Bail diameter : not less than 8.5 mm
4	1020330006	1,100 EA	Hotline bail clamp, with: Main line : diameter range of 9.3 mm to 19 mm (sizes 70 mm ² to 185 mm ²) Bail diameter : not less than 8.5 mm
5	1020330104	3,750 EA	Hotline protected thread clamp, with: Main line : diameter range of 6.6 mm to 19 mm (sizes 35 mm ² to 185 mm ²) Tap line : diameter range of 7.7 mm to 19 mm (sizes 50 mm ² to 185 mm ²) (sizes 50 mm ² to 185 mm ²)