



**Instructive for cold welding with
Protabond system.**

**Verifications and tests to assure
correct operation.**

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Instructions for Protabond cold welding application & good working verification.

Objective.

This instructive objective is that through its reading and comprehension, the field technician can perform a Protabond cold welding, and be also able to verify and test the good working conditions of the installed group.

Reach.

This instructive is addressed to the technical staff in charge of the application of the welding, as well as the inspection personnel. In general, to all people that must apply or verify the good working conditions of this type of welding.

Description of Protabond cold welding system.

Product uses.

Protabond cold welding system emerges to be used mainly as an alternative to the conventional cuproaluminothermic welding, although it doesn't stay limited to that field. The range of usage of the product is diverse, and its use can be considered everytime that two metallic elements need to be connected and assure permanent and free electrical contact between both.

The system can be used in connections that only demand tests and verifications, as well as cases where collection or injection of current through the welding.

However, this instructive will address the case of using the system as replacement of the conventional cuproaluminothermic welding. It is important to point out that the utilization of this system brings several advantages, being highly recommended instead of the conventional cuproaluminothermic welding.

Advantages.

Being this system a cold working condition one, meaning that is free of high temperature points, the advantages of using Protabond welding system, compared to other hot welding system, can be listed:

- Eliminates work risks attached to conventional cupro welding.
- Eliminates risk of facilities damages.
- No risks if used on flammable or classified areas.

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- No risks if used on high pressure or flammable fluids pipelines. (gas and oil pipelines, propane pipelines, etc).
- No risks if used on pipelines where thickness loss is confirmed or to be confirmed, cases where conventional welding would be extremely dangerous.
- Being a cold system, special permissions to decrease pressure on the pipelines are not necessary, which most of the times is not posible.
- Low installation difficulty.
- High electrical conductivity. The suggested nominal value for the welding is 30 Amps, if it is necessary to drain higher currents, can be distributed on several weldings.
- Once the system is installed and the curing times are properly observed, can be considered as a metallic fill with good structure, and it is for this reason that high values of current can be drained. As regards as peak values that go over the current nominal value (30 A) whose duration remains under 1 second, the product endures those peaks without any inconvenience. Numerous products already installed in diverse working conditions haven't reported failures or fractures caused by high drains of current.

Installation.

A cold welding installation can be performed easily, in compliance with instructions and easy considerations, which are also common to general welding or coating type of work. The skills required to the staff that will apply the product will be minimum, although will need to have general electricity knowledges, as well as surface preparation, use of manual tools and detailed way of work.

Verification of components.

Before execute the work, verify that it is at your hand all the hended tools to perform the welding, this incluyes the tools provided with the Kit, in addition to other necessary tools on every welding work (file, sandpaper, cloth, usual hand tools, etc.).

Do not use the Kit materials if you notice any failure or burst on it. Surface preparation. **(in agree with SSPC Standards: SP-2 and / or SP-3)**

Clean the surroundings of the pipe or surface where the welding is going to be located, clearing it from any remainder of dirt, grease, dust and old rust, paint, and soak through the coating until reaching the metal. The surface should be 5cm x 5cm.

Clean and prepare the metallic zone by using files or sandpapers, until observe the metal clearly clean, without any remainder of rust, adhesives or coating materials.

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Preparation of cable and terminal.



The cable insulating cover should be removed and shouldn't be longer than the length than the part to be introduced on the terminal hole, assuring to clean and remove any remainder that may be.

It is recommended to clean the copper with the sandpaper, to assure the highest cleanliness, and also to improve the essential contact between the conductor and the terminal.

Before inserting the cable on the terminal, a small amount of conductive epoxy must be applied to the cable, to discard any contact issues.

Mixing and application of the conductive epoxy.



The mixing of the putty must be done following the same procedures used when mixing 2-component adhesives, this is, using equal parts of the 2 components and mixing until obtain a uniform material. Note that, as with any adhesive, as soon as the 2 components mix, the product will start to cure, and therefore, to harden its consistence. For this reason, it is recommended to prepare only the necessary amount and at the moment to be applied.

Place the protective suction pad, and alter that, apply a small amount of putty on the cable before inserting it on the terminal, and another amount on the end that holds the spring, which is going to

be the piece permanently in contact with the pipe. The amount to be applied to the cable as well as the terminal that will be in contact with the pipe will be sufficient to assure the necessities contacts and adherences for the correct working conditions of the welding, but taking care of not to "overflow" on none of the two parts of the suction pad, this is the inferior and superior parts.

Sealing of the suction pad and application of the set on the pipe.

Apply a sufficient amount of contact adhesive on the external rim of the suction pad, and adhere the suction pad to the pipe or surface to be installed., following the outlines, and assuring to apply

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pressure for a minute, assuring the correct placement of the product. Avoid any movement of the components during the adhesion process. The amount of time that the group must remain static, as well as the pressure to be applied must be the longest possible.



Finishing of the welding.



Once finished the curing time, and after verifying the adherence of the set to the pipe or surface, it will be necessary to finish and coat the pipe, to which is recommended to use epoxy paints, application of Handycap, or combination of both systems.

It is recommended before going through the finishing, to perform the continuity tests listed below:

Continuity verifications of the welding.

Next, different tests will be described, which can be performed with the intention to assure the correct working condition of the welding. It is necessary that the operator or inspector that will perform the tests have general electricity knowledges, and also be familiar with the use of electrical test instruments.

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Verification with regular multimeter.

Almost all regular multimeters have the function to test continuity or electrical resistance, and the test is direct observing on the instrument's display the number obtained from the test. To perform this test, one of the instrument's test electrode must be placed on the welded cable end, and the other electrode on some point of the pipe or surface near to the welding. Precaution need to be taken to assure good contact between the instrument's points, and the measure points. Need to be said that regular multimeters are not precise enough to measure low resistances, like the ones used on weldings, thus the test in this case are conduces/does not conduce.

Verification with mili ohmmeter.

If more precise tests are required a more accurate instrument can be used, such as the miliohmmeter of 4 points, which is an instrument that applies current through 2 points and perform the test with the other 2. This way, by not having electrical current going through the testing circuit, flaws are discarded, such as the contact resistances, and a more precise test of the real welding resistance value is obtained. For more details about connections and how to perform the test, refer to the User Manual of the specific device used on the test. On this test, the cable resistance value must be subtracted, if it is of considerable length or thin section. The resistance value per length unit must be found through the cable manufacturer.

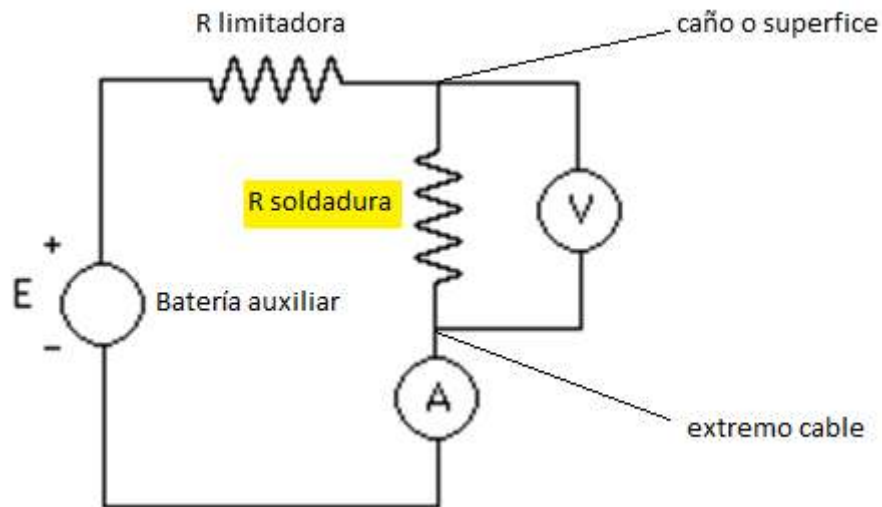
Verification through applied current.

If 4 point resistance tester is not available, a "home made" can be used, using regular multimeters (two), regular batteries and several resistances. The precision of the values obtained will depend on the quality of the instruments used on it.

A circuit similar to the 4 point mili ohmmeter needs to be assembled, to which is necessary a circuit applying current and other to test. The current circuit is obtained through the connection of an auxiliary battery, connecting one pole through a limitating resistance (R limitating) directly to the pipe, and the other pole on the end of the welded cable, but including in series on the circuit a multimeter, that will work as amperemeter. The value of the limitating resistance must generate on the circuit a current of 1 Amp.

With the second multimeter, obtain the tension value between the end of the cable and the pipe or surface to where it is welded. The value of the measure should be in the order of the milivolts.

For reference, use image below:



The exact value of the resistance is calculated through OHM Law, and is the quotient between the tension value and the current value measured with the instruments. The selected ranges on the instruments must be those who assure the higher precision. Also in this method precaution must be taken to subtract the cable resistance value if this value is significant.

Criteria and/or final inspection tests to consider for approval of an installation.

The welding will be considered as finished and accepted if complies with the following ítems:

- Verification has been made on the field that the pipe or surface where the welding has been applied has been treated properly, which is the remotion of rust, any remainder and that files and sandpaper has been used to clean the metal. Cleansing with Thinner-type solvents or other allowed by regulations on the installation area.
- The welding has been performed following this instructive indications and/or others that come with the product, and applied by qualified personnel and applied with detail.
- Verification has been made on the field the absence of contamination by any remainder on any of the steps composing the process of the realization of this welding.
- Continuity verifications mentioned in this instructive has been performed and determined that resistance is under 0.2 Ohm.
- Visually it is observed that final details are sealed and well presented.
- Once the device or equipment attached to this welding starts to work, verify that the current draining is under or equal to 30 Amp per welding.

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Instructions to obtain the best results.

With the intention of assure the best possible result using the product, next there is a detail of a series of instructions or recommendations to consider through the process of installation. This are general recommendations, and can be applied to any welding work or connections between cables.

- Consider above all, compliance with security regulations applied on the specific location where the welding is going to be applied.
- Application and verification of the welding must be performed by qualified personnel using materials and instruments. Good work quality assures good results on the welding.
- Keep order and cleanliness on the work area to avoid to contaminate materials to be used.
- The welding kit components must also be clean and free from any grease. Do not use it if you notice that any of the components is not in good condition to be used.
- The best result and lower contact resistance are obtained when the pressure between the contact terminal and the pipe surface is the maximum possible, for which is recommended special attention in this moment of the installation. Remember that the current circulates between the terminal and the pipe, and the minimum resistance is obtained when the contact area is bigger. On the other hand the function of the conductive epoxy is to fill all the gaps that may be between the terminal and the pipe, and those must be as least as possible, as well as provide mechanical fastening to the group. Hence, the amount of putty to be applied is the necessary to accomplish with this two requisites, but not excessive to overflow with the product.
- The size of the terminal is enough to assure good current capability, which will depend also of the section of the cable used. Hence, use terminal according to the cable to be welded to guarantee the current capability. However if the pretended current is higher than 30 Amp, it is suggested to perform several weldings to distribute the current., procedure also recommended on conventional cuproaluminothermic weldings.
- The acceptable resistance values of contact are up to 0.2 Ohm, though even lower values can be obtained if step described on this instructive are properly followed.
- Remember that the purpose of this kit is to provide a welding that assures the electrical continuity as well as the possibility of current supply. The mechanical adherence obtained with the product is more than enough for this purpose. Excessive traction can remove the welding, so that the installation needs to be done to avoid tractions on the cable, i.e.: underground cables. If this is not the case, a retention needs to be installed so that eventual manipulation doesn't affect the welding, with risk of removing it.
- If any inconvenient appears, or have questions regarding this product or its use, please contact technical department at Protan S.A. at protan@protansa.com - www.protansa.com

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Appendix 1 – Complete example of Protabond welding installation



Foto 1: Corte y limpieza de revestimiento HDPE de 5 x 5 cm. Posición horaria 12 Hrs.



Foto 2: Enrollamiento - aseguramiento del cable en el caño. El Handy cap y la sopapa son insertados en el cable.



Foto 3: Prensado de Terminal de cobre con el cable.



Foto 4: Limpieza de Superficie del caño y Terminal de cobre con producto P-30 (Kit Protabond).



Foto 5: El volumen mezcla por parte es de 0.6 ml. de la masilla conductora.PVC 20 (Kit Protabond) para cada soldadura en frío.



Foto 6: La masilla es aplicada en área de prensado del terminal y área de contacto con la tubería (resorte).

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Foto 7: Aplicación de pegante AC 10. Kit Protabond.



Foto 8: La sopapa se mantiene firme a la tubería durante 1 minuto.



Foto 9: Vista superior de soldadura en frío Protabond. Resistencia entre extremos de cable 0.2 Ohm.



Foto 10: Instalación de Handy Cap

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