New method to remove old paint

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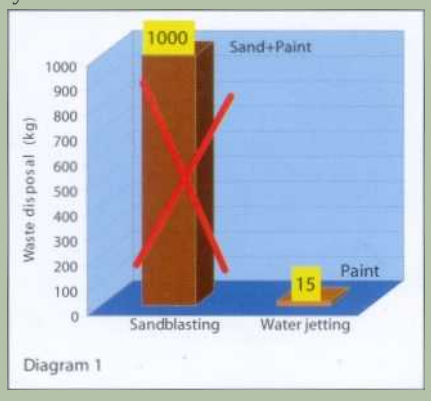
The removing of rust and old paint on steel is one of the most common works to be carried out in context to maintenance of ships, oil platforms and elsewhere in the industry. By the way, not only old paint. Shortly after painting it can be necessary to remove the paint due to reconstruction, reinforcements or other adjustments. Then it is with a certain surprise we have noticed that it has not been carried out more research on these processes because of the significance economic importance they have. In order to contribute to a more efficient paint removing, we therefore carried through a precise theoretical analysis of the mechanical paint removing process and evaluated what could be achieved. And we were greatly surprised. The analysis gave us much knowledge that will contribute too much better paint removal efficiency.

Introduction

Getting hold of correct data when optimizing a process or equipment is normally a matter of course, but already at this point we turned into problems. It should have been easy to find data for how firm the coating sticks to the steel surface to calculate how large forces the mechanical equipment must handle. The arguments against giving values of the sticking forces in the paint specifications may be that the forces varies with the surface condition, The paint temperature during application, etc, but for our purpose it is not a good argument, because the equipment also must remove paint with ideal sticking forces to the surface.

Sand blasting

The most widespread method for removing paint from steel is still sand blasting. This is a method that has been used during at least 40-50 years without significant changes, even though sand blasting has heavy disadvantages. The largest drawbacks are the need for covering during work, noise, dust, that it does not remove salt from the steel surface, etc. As if this is not enough, the method produces an enormous mix of sand and poisonous paint. To remove 15 kg paint from a steel surface, 1000 kg of sand have to be used. Afterwards it must be treated as problem waste. This is clearly illustrated in diagram 1. An enormous sand consumption that is costly both to buy and not at least to deposit in an adequate way. Then it is much simpler to handle paint without sand because of the small volume and weight and because it"can be refined, destructed or deposited in a secure and effective way. The reason for the huge sand consumption is that the grains hits the steel surface quite occasional and with variable forces. On ordinary type of steel surfaces the consumption of sand is as high as 80 kg for each square meter you treat. To achieve a satisfactory result we must use much more sand and air than what had been necessary if all the sand grains had hit the surface perfect side by side which of course is impossible. The sand blasting efficiency therefore is quite hopeless and the costs accordingly high. Other and more effective ways for paint removal hopefully will replace sand blasting within few years.



Enormous sand volumes are consumed to remove paint when sand blasting. This problem waste can be avoided if sand blasting is replaced by water jetting.

How firm sticks paint to the surface?

To be able to optimize this process we found it quite necessary to study the forces needed to mechanically remove paint. After close investigations among other things of adhesive data between steel and modern ships paintings, we have found the force between sand blasted steel and paint and the shear strength of the very best two component paintings. It was somewhat lower than we had expected in advance, especially seen in the light of the high water jetting pressure everyone always have used so far to remove paint.

The jet forces from water jetting

The forces from the water rise when the motion energy in the water is transformed into pressure when the jet hits the surface. The pressure energy that arises in the water jet must be so high that it surmounts the cutting strength in the paint. And here the problems start if you are using rotating nozzle, a solution that till now has been universal. The jet bursts because of the centrifugal force from the rotation. The water beams, that should have been solid, increases in diameter and fills with air, and the intensity where the jet hits the surface becomes less. Of course, the specific weight of the water/air mixture becomes much less than in a compact water jet and thereby the mass forces are strongly reduced. In addition the

jet is springy (compressible) because of the air content. All these are adds up in a very limited burst pressure when the water jet hits the surface. A miserable efficiency is the result. In sharp contrast, Speedclean linear nozzle without rotation will manage to keep the intensity high in the jet so the motion energy can be transformed to efficient rust and paint removing work. We have calculated how the efficiency from the jet reduces with the distance from the nozzle. Examples of the efficiency results you get in water jetting are shown in diagram 2. It shows with bright clearness how bad a rotating conventional nozzle is in comparison with Speeders linear nozzle. At a 12 cm distance from the nozzle to the surface, the rotating nozzles loose half of their efficiency and at 20 cm they loose approximately 2/3 of the power. The result from this is that Speeders non rotating nozzle, on this point alone, is 2 to 3 times more efficient than all the others, and the difference from others increases with increased number of revolutions. It is therefore with great astonishment we observe that other manufacturers are advertising with high number of revolutions in their rotating nozzles, when they in this way get even lower efficiencies.

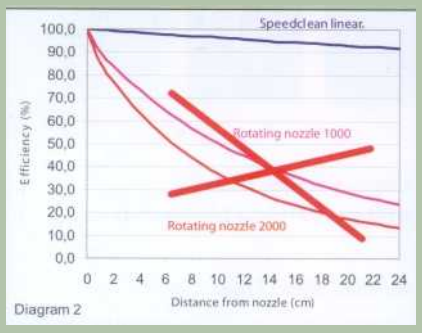


Diagram 2

Rotor nozzle water jets burst by the centrifugal force and the efficiency disappear shortly after the nozzle in sharp contrast to Speedclean linear nozzle where the water jet does not rotate.

Linear motion

The water jets from Speedclean linear nozzle moves linear along the diameter crosswise the lance moving direction, while the jets from rotor nozzles move in whole circles. This means from simple calculation that we on this point are alone and operates 3.14 times more efficient. Using our water jetting machines with linear nozzle you will be efficient from the very beginning of the area. It will be easy to limit the area that shall be cleaned from paint and rust. The Speedclean jet works efficient all the time because you "skip" the time and energy that will be wasted in rotor nozzles, while their jet passes the circle sides and the returns over clean area in the rear side of the circle.

6 to 10 times more efficient

Since we have these improvements it is correct to multiply them together when making comparison with other water jetting machines with rotating nozzles. Than we get 6 to 10 times improvement for our water jetting machines with linear nozzle. This imply that our water jetting machine with 3 liter pr minute water capacity has a paint removal capacity equivalent to all the others with 18 to 30 1/mm. But Speedclean will consume only 1 /6 to 1 / 10 of the energy in proportion to the others with their rotating nozzles. Most of the wasted power those use is to rub again and again over the same area in the sides and rear of the rotating circle. With our linear nozzle solution you will always get equal strain over the whole area. You can also use the jet in a small angle to the surface and almost peel of the coating with only a minimum strain on the material. By using the right angle on the water jet all the time on rust and old paint, the enormous jet speed and pressure will peel of or burst away everything that you want to get rid of in a very efficient way.

Working speed in comparison with sand blasting

From close comparisons between sand blasting and our water jetting we are not in doubt that water jetting now will compete much better against sand blasting, also on efficiency and costs even without taking into consideration all the advantages mentioned in the sand blasting chapter earlier in this article. We are therefore convinced that all the knowledge we have added to this business by careful studies of the water jetting processes will revolutionize this business. Our prediction is that it will go through a generation change and really become much better than ever before, to great pleasure for both customers and users.

Cost efficient solution

Speedclean linear nozzle gives an efficiency increase between 6 and 10 times! Yes, you read it right, 600 to 1000 %. It may be unnecessary to tell, but with Speeders solution we will, of course, reduce the costs dramatically in comparison to both sand blasting and the present water jetting machines. To reduce the costs even more, our production of the Speedclean water jetting machines will start when we have got enough orders to run the production, also of these machines, very fast and efficient. In this way also the customers will be able to really take their natural share of the profit.

Reflections

We could not avoid making some reflections when working with such a solution and discover how low efficiency the earlier solutions had. Even though this technique was a relative new technique, all the other manufacturers have gone into the same huge pitfalls. In this case rotating the water jet through the whole circle, instead of crosswise along the diameter. Everyone of them have rotated the water jet so it bursts and gets to little intensity when the cross section increases and that the water jet fills with air and becomes compressible so their efficiency is hair-raisingly low. Probably the first manufacturer that has started using a rotating nozzle for water jetting, has assumed that a rotating nozzle must be a good solution without doing a precise theoretic

analysis of all the speeds and forces in the water jet. And I suppose that all the others as usual have copied the solution, without putting question marks with it. Only shoveling on higher pressure, larger and high-priced pumps and motors have compensated missing efficiency. That gave us the possibility to increase the efficiency in the process with 600 to 1000 %.

Of course, we in Speeder do not complain so much about that. In this context the following saying will suit very well: "By hook or by crook a dwarf can be stronger than a giant". The moral that many should draw from this case is that it rarely pays off just copying a solution you don't fully understand, and believe that everything is in perfect order. Then you can later get a great deal of unpleasant surprises. The equipment users will also do themselves a favor if they assure themselves that the manufacturer they are going to buy from fully understand technically what they are doing and not only copies from others. Otherwise they might easily be stuck with very expensive and outdistanced equipment.

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