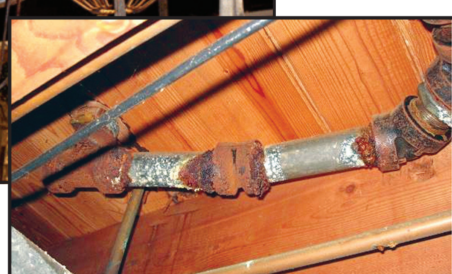
Why We **DON'T USE** *Hot Dipped Galvanized Steel*

When Fabricating Our Steel Frames, Clips & Connectors

I have addressed the question from inquiring customers of why we do not use galvanized steel/tube at least several hundred times in the past. Let me set the record straight, and tell you the dirty little secret about the galvanizing process, and how if you think it is a fool proof way to make steel last a lifetime, your wrong... Your wrong only because you have been given bad & bogus information.

This Is A Welded Steel Fence With Galvanized Square Tube.

Here's WHY We Dont Use Galvanized Steel... This Fence Looks Like It Should Be In Some 3rd World Country - Not The USA...



All Pictures Are Of Applications Of Galvanized Steel That Rusted & Rotted Away...

There is a lot of misinformation out there about the use of galvanized steel. I hope the following clears up some of that misunderstanding about why we do not use it...

People who do use galvanized steel when building their product are proud that they use galvanized steel. This paper will clear up some of the misconceptions people have about using galvanized steel over un-galvanized steel. Our competitors sell galvanized steel as an upgrade, which it's not in my opinion. They sell their products made with galvanized steel and they purport it to be a 'lifetime treatment' for steel and that it will never rust, rot, corrode, peel, chip or stain... ***Galvanized steel is not and never will, make steel impervious to the assaulting elements of Mother Nature.*** If it was 'forever lasting' protection from steel rusting, *Why wouldn't bridge builders use galvanized steel when building bridges.* I know the answer... ***It's because they know at a future date galvanized coating will crack, fail & rust.***

This Is Galvanized Steel Used On Roof Tops.

Hot dipped galvanizing is a molten zinc coating that's applied to steel as a rust retardant.

It's applied to steel at heats as high as 850˚. Heat this high when applied to raw steel has a tendency to break down the molecular structure of the steel and make it react unfavorably under certain stress conditions. In other words re-heating a piece of steel to ½ its melting point changes the molecular structure of the steel and it stands to reason that the steels tinsel strength would be challenged.

The hardness of the dried zinc coating and heat created by virtue of the application process creates a few problems when fabricating metal parts that need to maintain a high degree of structural strength and integrity. The temperature at which hot galvanizing is applied to steel attacks the strength & integrity of the steel and almost always warp's the steel and makes it brittle. Steel that's been hot dipped galvanized at 850˚ plus can reflect a less than perfect finished fabricated product resulting in an inferior fit of all galvanized pieces & parts during the erection process.

Since the hot dipped galvanizing process creates a hard coating it makes it somewhat resistant to machining. This brittleness of the galvanized finish equates to poor bending & machining capabilities and limits the steels impact resistance. If you were to bend or impact galvanized steel during the fabrication process, chances are greater than not that the zinc coating over a period of time will chip, fracture, create a fissure in the surface or break off exposing the underlying steel to corrosive elements. Chances are if you have to adjust the product at the job site with any kind of force or impacting coercion you will most likely chip the top coat and at that point you have created a fissure in the coating which will spread and eventually promote rust and the steels demise.

The following is probably the most serious insult that companies who build with galvanized steel foster on the unsuspecting purchasing public when telling a client by buying a galvanized steel product they are fully protected from rust because the steel is galvanized with a super heavy duty 3 or 4 coats of hot zinc galvanization.

If the manufacturer buys their steel tube galvanized in long lengths and then has to cut & weld up pieces and parts in their shop you might be surprised to hear that when they cut their parts up out of the long steel and weld them together that on every weld they make during the fabrication process there is no galvanization as it is exposed raw steel plus all of the welds made are exposed as they have no galvanization on them. Every weld that is not galvanized but painted is an opening for corrosion. All they do after they weld up the exposed raw steel is paint their welds with a silver paint to match the galvanized finish. After a few years of exposure to the corrosive elements rust sets in thru the weld and travels under the galvanized finish coat and releases it. The only way one can make the right decision when purchasing a galvanized finished steel product is to find a company that galvanizes their product after their pieces are fabricated and welded together.

If you still insist on having a galvanized product then that is the only safe way to guarantee that the zinc has been applied properly for the longest lasting protection.

Keep in mind this is just one man's opinion about galvanizing. At this time I feel safe in saying that we will never use galvanized steel in our products as we want to provide the strongest & best steel products available anywhere.

PLEASE CONTINUE READING BELOW

STOP

READ BEFORE PURCHASING ANY GALVANIZED STEEL PRODUCT

Below are threads of
international manufacturers & metal experts talking about how the galvanization process weakens the strength and integrity of the steel. The long term outcome of a galvanized coating on steel that is supposed to protect it is unpredictable at best. As you read thru the threads below you will be able to see that the process of galvanizing steel is a hit or miss business, sometimes it works and sometimes it doesn’t. Its not a process that works every time and it only matters if you bought a galvanized product that did not work, because all you have then is a gigantic, weak, rusty, ugly mess!

YOU WILL NEVER SEE THIS INFORMATION IN PRINT IN THE UNITED STATES OR ON SITES THAT SELL GALVANIZED PRODUCTS.

THIS INFORMATION IS PRICELESS IF YOU ARE ABOUT TO PURCHASE
A HIGH PRICED GALVANIZED STEEL PRODUCT.

THIS INFORMATION PRESENTS SOME OF THE REASONS WHY “ALL STEEL SHED FRAMES”
DOESN’T AND WILL NOT USE GALVANIZED STEEL IN ANY OF OUR STEEL FRAME PRODUCTS.

Has hot dip galvanizing weakened our mounting brackets?

April 30, 2009

Sir,

We have a component manufactured for the Wind Mill Tower, which is a mounting bracket (10 mm Thick) used to mount the Platforms at the various levels of the tower. This bracket is having material grade S355 equivalent Indian Standard IS-2062.It is a mild carbon steel. This bracket is having a 90˚ bend and gets clamped at both ends at a right angle. This material is Hot Dip Galvanized. We are finding cracks at the assembly stage from the bending line (Bending is having a radius of R16. We have done a testing at our end by loading the component as done at the assembly stage, the pieces without galvanizing did not fail, but the pieces after galvanizing tested after 3 days of galvanizing failed from the radius. Is the galvanization process playing the key roll for the failure?

Regards,
Benny Michael

Benny Michael,
Fabrication - Hyderabad, Andhra Pradesh, INDIA
(Privately contact this inquirer)

May 1, 2009

Is the actual steel failing or just appears to be cracked because the galvanize cracked.
If the part went into the zinc vertically, I can not see a good reason for it to crack.
Dr. Cook will probably have technical reasons in a day or so.

James Watts,
Navarre, Florida

May 5, 2009

Hi Benny,

I infer that you are doing the bend cold (less than around 600° C), otherwise your problem wouldn't occur. The hot dip galvanizing is causing your problem, because the bend radius is too tight for a cold bend.

Onesteel Australia have published an FAQs document dealing with concrete reinforcing bar, including the galvanizing of cold-bent bar. Here is the relevant FAQ cut from the document *(which does not carry a copyright note):*

Quote
Q. ***Does galvanizing have any detrimental effects on bent bars?***

A. Bent rebars that are subsequently galvanized can be affected in a number of ways. Heating of the steel to 450° C will induce some degree of strain ageing into the cold worked section of the steel. Immersion in a pickle bath to clean the steel may induce some hydrogen embrittlement in the steel. Immersion of steel in a molten metal zinc bath can cause liquid metal embrittlement due to absorption of zinc into the steel grain boundaries.

For these reasons bars should not be bent around pins of less than 5 db for bars up to 16 mm and 8 db for bars greater than 16 mm. It is preferable to bend bars after galvanizing in order to overcome any potential for small surface folds, that may be formed in the bar surface during

bending around small pins, to become a surface cracking problem in bent and galvanized rebars. We do not recommend that pre-bent and galvanized bars be rebent on site.
End of quote

If we apply the Onesteel radius limit for bar, to your plate, you would have a limit of R25. Maybe the limit should be higher than that because of the different geometry of plate vs bar. Either way your R15 is too tight.

Assuming that you need the R15, and assuming that you don't need the additional strength at the bend brought about by the cold work, you could do the bend then temper at around 650 degrees C then go to hot dip galvanizing. The temper would remove the effects of the cold work.

Or you could heat the strip to around 900° C with a torch and bend it hot then let it cool naturally, which would give you no cold-work effects at all since you would not be doing any cold work.

Or you could hot dip galvanize the strip first, then bend it cold. Obviously you would need to run some test pieces first to check how tight the bend could be without the zinc being damaged. A matter of absolutely major importance is the silicon content of the steel, because certain silicon contents in the steel can lead to brittle zinc coatings which would crack on a tight bend (although their corrosion resistance is normal). This post is already quite long enough without going into the silicon question in detail, but we can deal with it if you wish.

Bill Reynolds,
Consultant metallurgist
Ballarat, Victoria, Australia
It is this website's profoundly sad duty to relate the news,
that Bill passed away on Jan. 29, 2010.

May 8, 2009

Sir,

I take a different point of view about your problem. Since the ungalvanized bracket does not break, I believe that is proof enough that the galvanizing caused the problem. If you post publically, or e-mail me privately the composition of the galvanizing bath in which these brackets were galvanized, I would be happy to comment.

Regards,
Dr. Thomas H. Cook,
Hot Springs, South Dakota

May 18, 2009

That's what I said in my first paragraph "The hot dip galvanizing is causing your problem...". Dr Cook, what are you disagreeing with?

If an amount of cold-work exceeding some threshold level is done prior to galvanizing, then the subsequent galvanizing will cause a problem in that cold-worked material.

Possible solutions are (1) reduce the amount of cold work if the application permits (that is, use a larger bend radius), or (2) bend hot so that no cold-working is done - subsequent galvanizing will then not damage the bend zone.

Or (3) galvanize first then bend, but be aware that the silicon content of the steel is important, to avoid a brittle zinc layer that might crack when bent.

Bill Reynolds,
Ballarat, Victoria, Australia
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May 22, 2009

Bill,

I found your technology on bending quite interesting and this may well be exactly what is causing the problem.

I was thinking that the galvanizer of these brackets may be using more than 0.3% tin (SN) in his zinc which has caused many, many cracking problems in Europe and North America. Unfortunately I could not get information about the zinc in the kettle to verify my thinking.

Galvanizers have found that tin in their zinc reduces zinc usage, perhaps by lowing the freezing point of the zinc allowing better zinc drainage back into the kettle. Unfortunately this tin content, above about 0.3% causes cracks in stressed steel and MANY failures have been reported including:

1)Hanging wires breaking in galvanizing plants in the zinc.
2)Overhead highway signs cracking.
3)Stressed steel bridges failing.
4)Pipe pilings spliting sometimes like a banana being peeled.
5)A stadium roof structure cracking and needing braces.
6)Rectangular welded structures cracking and breaking.
7)Scaffolding cracking and failing.

One company in a patent recommended 0.5% tin and since has lowered this recommendation to 0.2%. Another company recommended above 1% tin and is contained in their patent. The second company has been successfully sued.

Tin causing the cracking has been carefully studied and PROVEN to be the problem. In any case of failure the failed galvanized product can be tested tin can be proven to be the cause.

About eight years ago I became aware of the problem and sent two letters to ASTM recommending a limit on the use of tin in hot dip galvanizing. My understanding is that no action was taken by ASTM because "Cook lacked sufficient proof." I have both dated letters and I have the full scientific paper which proves that tin is the problem.

Regards,
Dr. Thomas H. Cook,
Hot Springs, South Dakota

May 22, 2009

Dr Cook, thanks for your extra information.

I agree entirely with you that tin in the zinc would be damaging. Steel and molten tin make a very unhappy partnership. Even when the tin is in dilute solution in another molten metal, intergranular penetration by the tin can effectively form microcracks in the steel surface which can then easily propagate when lightly stressed. (The successful use of tinned steel sheet for cans is another story - highly polished steel, very soft steel, different steel microstructure, low service stress, etc etc - and tinplate was made by hot-dip tinning for very many years before electrolytic plating)

But surely the use of tin in the kettle would be unusual? It's not a constituent of zinc blocks from the zinc refinery, so would have to be a deliberate addition. Was it just for the purposes represented by the patents you mentioned?

The information that I quoted from Onesteel in fact deals primarily with the temperature cycle imposed on the steel by the galvanizing process, rather than details of the zinc itself. Similar degradation of the steel properties would occur if a furnace was used to impose the same temperature cycle as occurs in the kettle, on the same amount of work-hardening, in the complete absence of zinc or tin or any other metal.

So there are evidently two distinct paths, each of which leads to premature service failure - excessive cold work followed by galvanizing which imposes a damaging temperature cycle on the bulk steel, or excessive tin in the zinc which causes degradation of the steel surface.

I sympathise with your attempts to get something new into an ASTM spec - it's bad enough trying to get an editorial correction made of an obvious error!

Bill Reynolds,
Ballarat, Victoria, Australia
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