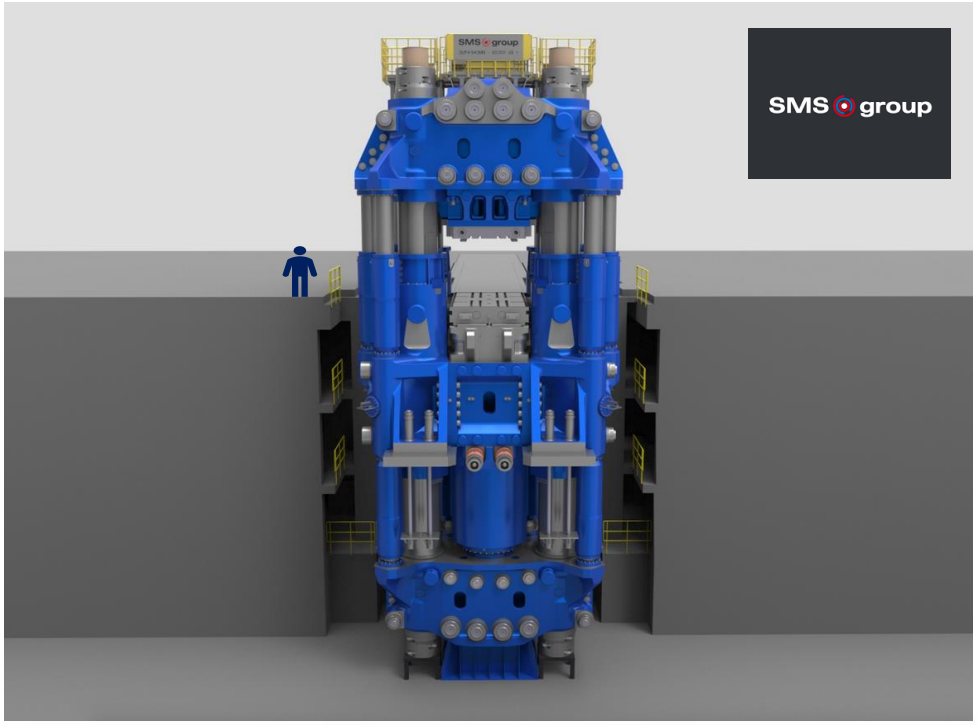
Issue
June 2018

PIT News

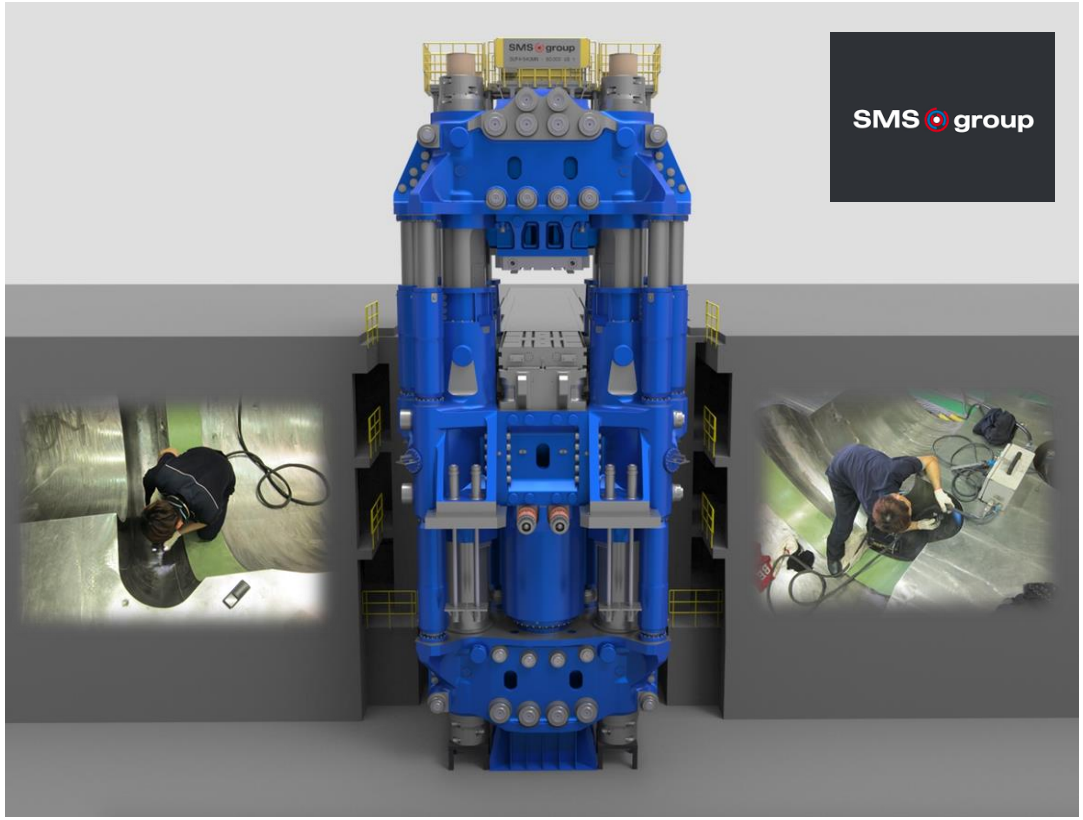


Content of this issue of PIT News:

- **PIT on the world's largest forging press 60k**
  - SMS uses PIT on the largest press to date
- **IIW provisions are very conservative**
  - IIW recommendation includes large reserves
- **HFMI is far more than just a higher frequency**
  - important information regarding reproducibility
- **Preventative PIT treatment on hammer head**
  - stands in clear relation to repair
- **PIT advantages for automated use**
  - integrated contour equalisation absorbs tolerances
- **PIT accessories – new 3D printed PIN holder**
  - allows changing of the PIN holder without tools
- **New international partners**
  - JinHeung South Korea & Baaten Be/Ne/Lux

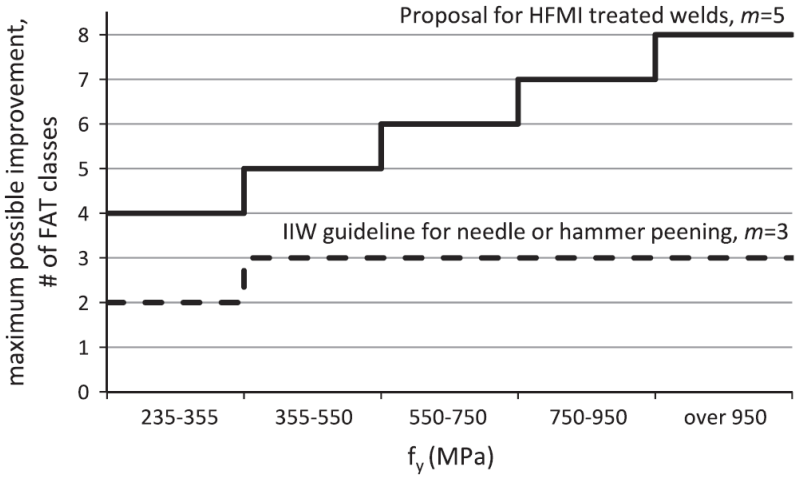
SMS group was commissioned by OTTO FUCHS Group to set up the new 540-MN-strong hydraulic press in Paramount, USA, the location of its subsidiary Weber Metals. The system is also called the 60-k press because it can exert 60,000 short tons (US) pressing force. The lower crosshead, assembled from four parts, was successfully installed in the press PIT using.

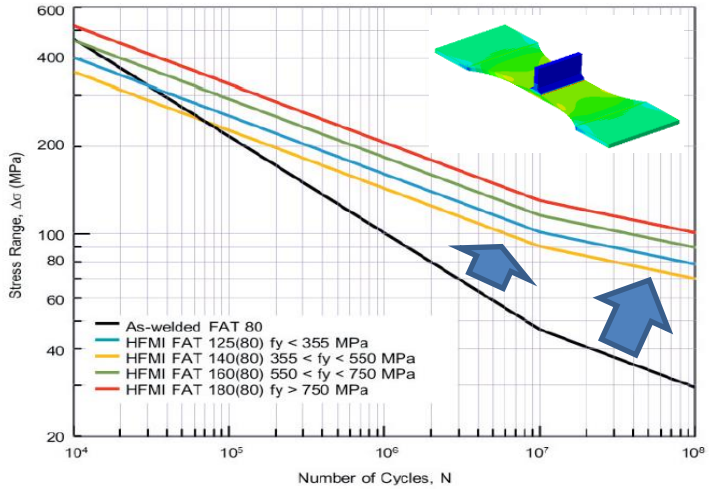
Also see: www.sms-group.com/press-media/drop-forging-machine-otto-fuchs/



The PIT Team is particularly proud of having contributed to achieving the required resistance values in accordance with fatigue guidelines through the surface treatment of the undercut surface of several drill holes, i.e. of an unwelded surface. It should also be mentioned in this connection that SMS chose PIT rather than shot peening despite having a surface of more than 8 m².

IIW Recommendations takes increasing yield strength into account





Hammer peening is not the same as HFMI
A clear difference is shown here between conventional "hammer peening" and the new HFMI methods

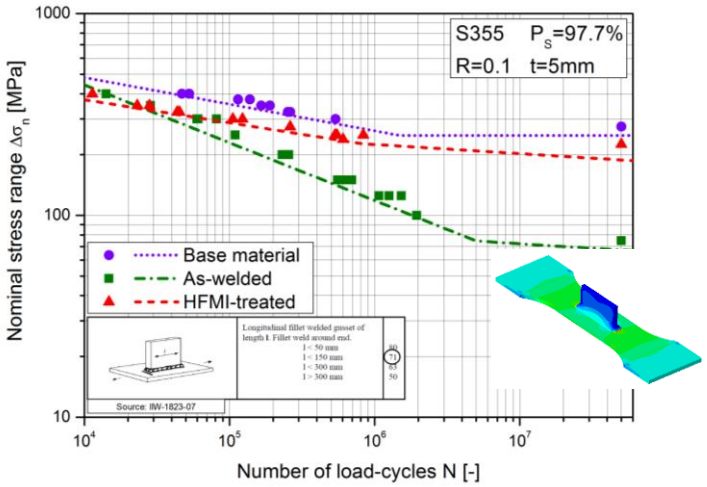
- There are clear differences in effect already noticed on low strength steels (235 to 355 N/mm² yield strength)
- However the increase in fatigue strength rises further on higher strength steel qualities

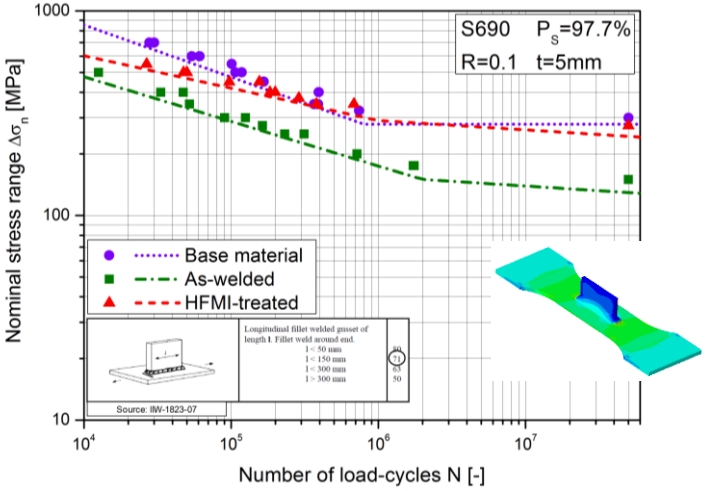
Typical diagram for a T-joint:

- As welded without HFMI treatment
  => FAT 80
- HFMI treated condition for steel qualities < S355
  => FAT 125 = increase > 55%!
- HFMI treated condition for steel qualities 550-750 => FAT 160 = increased by 100%!

Marquis et al.: Fatigue strength improvement of steel structures by high-frequency mechanical impact: proposed fatigue assessment guidelines, Welding in the World, 2013

Cautious IIW Recommendations includes large reserves





We show the reserves using a longitudinal stiffener:
For structural steel S355

- FAT class in "as welded" condition
  - IIW: FAT 71
  - tests result: FAT 97
- FAT class in HFMI post-treated condition
  - IIW: FAT 112
  - tests results: FAT 217

→ ***The FAT class is clearly exceeded in the experiment compared to the IIW guideline for HFMI (+94%)!***

For high strength steel S690

- FAT class in "as welded" conditions
  - IIW: FAT 71
  - tests results: FAT 150
- FAT-class in HFMI post-treated conditions
  - IIW: FAT 140
  - tests results: FAT 280

→ ***The FAT class is clearly exceeded in the experiment compared to the IIW guideline for HFMI (+100%)!***

Leitner et al.: Fatigue enhancement of thin-walled, high-strength steel joints by high-frequency mechanical impact treatment, Welding in the World, 2014

HFMI – much more than a high frequency

HFMI is currently the most efficient post-treatment method with the greatest effect in relation to increased fatigue resistance. However even though the name suggests this, the HFMI effect is based on far more than just a higher frequency.

Conventional hammer/needle peening also induced residual compressive stress in the surface and thus achieves improved fatigue resistance. However it was always too risky to count on these effects because the results that were achieved varied too much. This was because of the varying contact pressure by the user in this procedure, which had such an influence on the residual compressive stress that the results varied from really good to insufficient.

Professor Efim Statnikov, the inventor of the first HFMI system, developed a procedure with UIT that maximised the effect but above all also ensured reproducibility so that it was possible to count on the effects sustainably.

Besides optimal impact intensity the user's contact pressure also needed to be decoupled in such a way that the same intensity always reached the component. He achieved this by mounting the vibration transformer on spring bearings in the casing, thus causing the same intensity to reach the component every time within the spring range.

PITEC not only mounted its striking mechanism on spring bearings but also only activates the process with a proximity switch when the device is inside this spring range. In this way PITEC has not had a single failure to date that could be traced back to a lack of reproducibility, despite having probably treated the most R&D tests and numerous industrial applications.

There are already greater or lesser differences in reproducibility in the 4 HFMI processes named by IIW, as has been proven in individual projects. Thus own processes cannot offer test procedures such as the modified Almen test offered by PIT or UIT because they produce different results on every test strip.

As with all successful technology the first processes are now coming onto the market that we consider to be simple hammer/needle processes and are offered as HFMI processes merely based on a striking frequency of ~100 Hz.

Hammer heads

A hammer head generally needs to be repaired every 1 – 1.5 years due to fatigue cracks caused by the high dynamic loads.

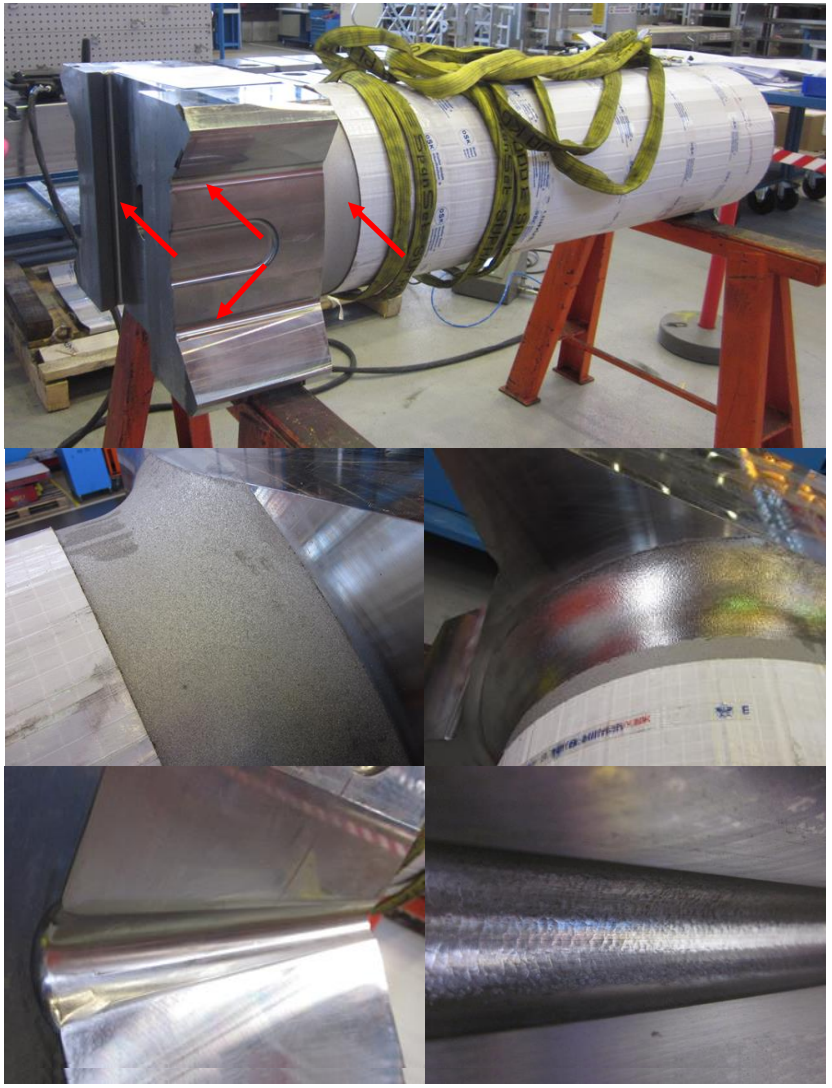
As well as the repair cost of 15-25 thousand € this also requires:

- Dismantling and transport to the repair company
- Grinding of the crack with subsequent repair welding as well as reforming by machining and grinding.
- Return transport and assembling

Preventive PIT treatment of the hot spot at considerable lower cost would already substantially extend the damage interval.

In this example the work took 6-8 hours plus travelling costs. So this would already pay off after a 15% extension.

However PIT achieves multiples of this!



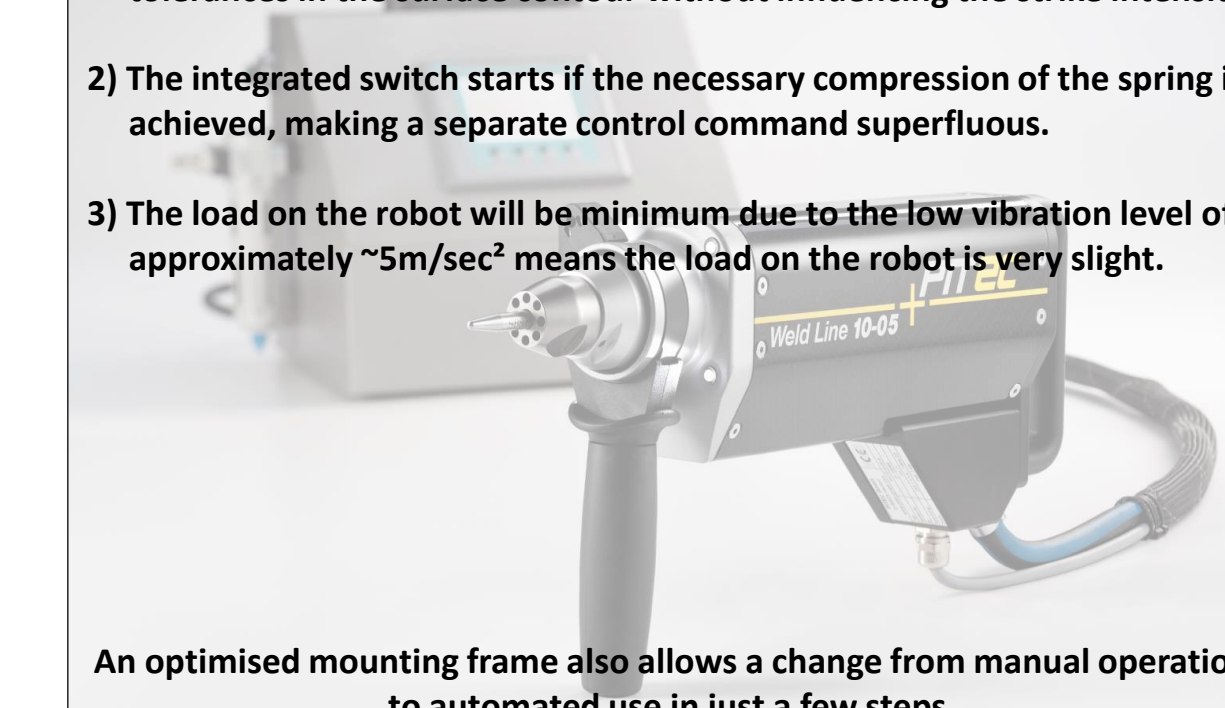
Advantages for automated applications

The striking mechanism, mounted on spring bearings for optimum reproducibility, offers further advantages for automated applications

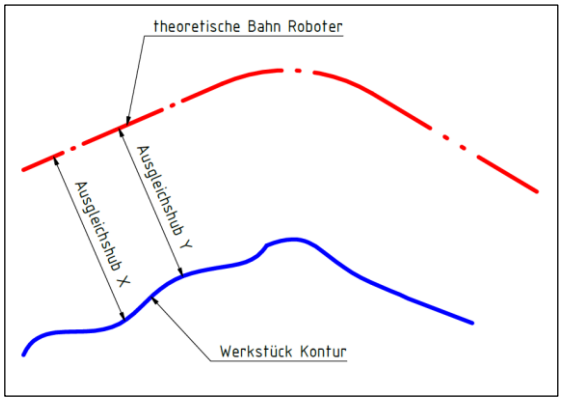
1) The spring range of the decoupling system automatically corrects tolerances in the surface contour without influencing the strike intensity.

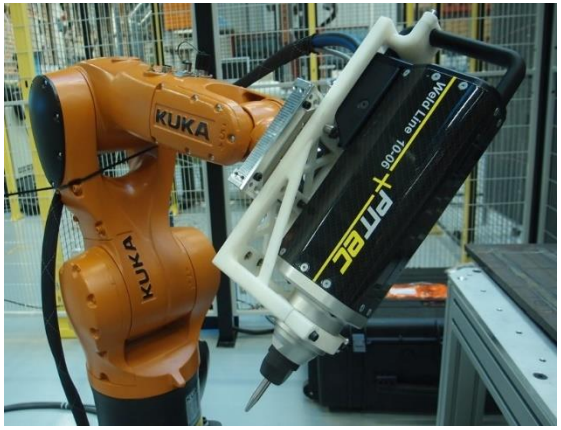
2) The integrated switch starts if the necessary compression of the spring is achieved, making a separate control command superfluous.

3) The load on the robot will be minimum due to the low vibration level of approximately ~5m/sec² means the load on the robot is very slight.



An optimised mounting frame also allows a change from manual operation to automated use in just a few steps.





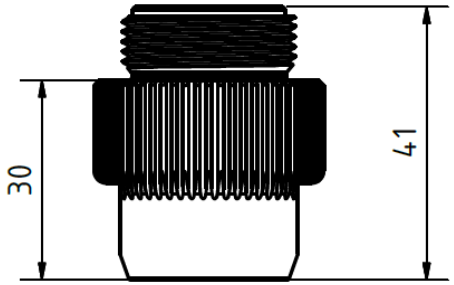
3D-printed pin holder for fast pin changes

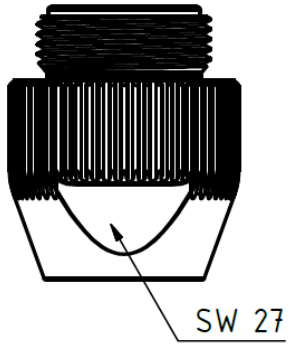
Available immediately for order!

This pin holder is made of plastic in a modern 3D-printing process and, even if the wear resistance of these new holders can't met the values for the traditional tool steel they still have an absolutely acceptable durability.

The advantages of this holder are the faster pin changing without a tool, will quickly pays dividends, especially when frequent pin changes is required.

If used on sensitive materials any contamination with steel particles that are created from wear between the pin holder and the steel pin are almost completely ruled out.





PITEC gains more cooperation partners

For South Korea

We have been able to add the successful family firm JinHeung as a partner. The company will look after the South Korean market as official and exclusive PIT Partner from July onwards.

The PIT Team is very happy to have added such a competent and wonderful company as a partner.

For Be/Ne/Lux

we have been able to add Thomas Baaten, who has done decisive work as a former employee of the Belgian welding institute on various HFMI projects for IIW and Belgian industry and who has now based his consultancy company on the sectors of welding technology, fatigue and HFMI.

The PIT Team is very happy to have added such a competent and wonderful individual as a partner.

Thank you for your attention!

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