AFTER OVER TWO YEARS OF R&D AND TESTING, A NEW BENDING MACHINE IS READY FOR THE MARKET. PAUL WAANDERS, INTERNATIONAL SALES MANAGER, MAATS PIPELINE EQUIPMENT, THE NETHERLANDS, INTRODUCES THE NEWBORN.

Figure 1. Bending 762 x 30.8 mm pipe.

STRAIGHTENING OUT ALL BENDING ISSUES

Over the last 15 years, Maats Pipeline Equipment in the Netherlands has had bending machines of all common brands in its rental fleet. These bending machines were rented out to customers all over the world and carried out their work in a large variety of climates and project situations, and sometimes in harsh conditions. These are the moments when machinery and personnel are truly tested. With reliability and easy operation being most important, Maats decided to take all the good aspects of available bending machines and bring them together in one better machine.

All machinery, and especially in a rental fleet, should be in 100% condition. The worst that can happen to both a customer and a rental company is having problems with equipment. With bending machines often working in extreme remote locations, sometimes half way around the world, bringing parts and technicians for repair to such locations (often only reachable by travelling several days) takes a lot of time and money, things a project generally cannot spare.

One of the main reasons for technical problems specifically with bending machines is the change in pipe material specifications over the last years. Developments in the industry have resulted in engineering of new pipelines with increasing lengths and operating pressures, resulting either in a larger wall thickness or an upgrade in material quality. Also, there are pipelines built for 'newer' mediums such as carbon dioxide, methane and other fluids, gases and vapours that behave differently from the traditional ones. Where in the past, pipelines and therefore the necessary pipeline construction equipment was designed based on steel grades starting with X52, with X70 being special and X80 being an exotic, nowadays grade X70 has become the standard, often with increased wall thicknesses. It has now gotten to the point where even grades X90 and X100 are viable options for future projects. These high strength steels allow (so far) for a reduced wall thickness, making pipe handling easier (weight saving can be more than 20%) and welding quicker. Therefore, these higher grades of steel can also be an economically attractive alternative. The increased wall thicknesses and high strength steels, however, require a different layout of especially bending equipment.

Based on the company's experience with bending machines over the last 15 years, carefully analysing all known breakdowns, Maats has concluded that it is not a simple matter of increased power in order to handle increased wall thicknesses or higher steel grades. The machine should also be more reliable with regard to its hydraulic and electrical systems. Moreover, its layout should be simple. Wherever in the world, it should be easy to service and in the unlikely case of a breakdown, it should be easy to repair quickly. A machine that works every time, all the time, wherever the project. In addition, the company insisted that this machine should not be more expensive to buy, rent or maintain than comparable ones.

This is a somewhat obvious summary of requirements, to both manufacturers and users, but how can this be translated into a machine that is indeed provable better and still competitive against comparable equipment currently on the market? In the end there was only one way to find out: to build one. As a first, it was decided to engineer and build a medium sized bending machine, suitable for 22 - 36 in. pipe. This project would be large enough as an exercise to test if the plans and ideas would work in real life, but small enough to keep it financially manageable.

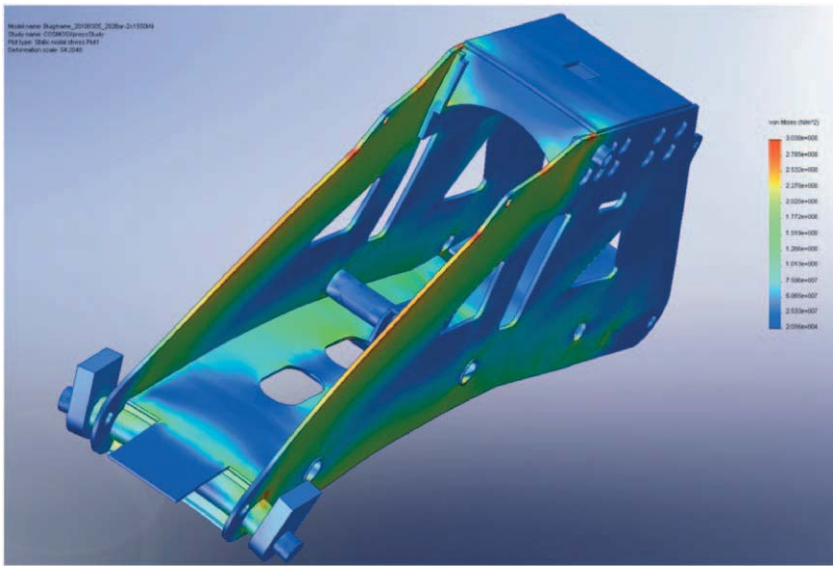

Figure 2. Stress calculation model.

Stronger

Of course a bending machine is largely about power, about force available to bend all common specification pipes. When starting with something new, however, it is important to stand out from that what is currently on offer and in this case, to build a stronger machine. Therefore, goals were set beyond that what is commonly available at the moment. The base for designing the first machine was a 36 in. pipe, grade X100 with a wall thickness of 1 in. Where this wall thickness of 25.4 mm might not seem to be a great amount, burst tests with 36 in. grade X100 pipes proved that with as little as a 16 mm, wall thickness, pressures of 150 bars and even above give no problems. Moreover, as much as this might seem an unnecessary requirement at this moment, bending machines often have lifecycles of up to 30 or 35 years. If not now, specifications will continue to evolve and a greater wall thickness will be a requirement in the (near?) future. Maats aimed to make a machine ready for these higher specifications, without having to change the complete layout or individual parts of the bending machine anytime soon.

Obtaining sufficient force is not a problem with the modern hydraulic systems available. The bigger problem is to construct a frame that can withstand the forces that occur when bending heavy wall pipes. There have been plenty of examples of cracks in frames, often in specific locations and often after only a few bends. That is why the company had two stress calculations made, one internally and another by a third party, just to make sure that the machine's power would not work against itself.

One of the most important results of these calculations was that the side plates of the main frame are now not only 10 - 15 mm stronger but also in a high tensile strength steel.

An additional advantage of working with such an 'oversized' layout is that there is no longer any doubt that the 22 - 36 in. bending machine is capable of bending 36 in. pipe, regardless of a larger wall thickness. It can and it will, without any problem. When selecting a bending machine, the wall thickness is now less important; it is more a question of the outside diameter of the pipe, to see if it fits the bending set.

Reliable

In order to build a reliable machine, all used parts, including the smallest ones, should be of proven quality. This means parts that have been used for many hours in a variety of conditions and without any problems. As a global exclusive dealer for LIEBHERR pipeline equipment, for Maats the choice was fairly easy. LIEBHERR has a 60 year experience with building construction equipment.

The engines, hydraulic cylinders, hydraulic pumps and other parts used in these machines have proven their quality on job sites all over the world.

Within this range of components, all major parts needed for the bending machine were found. As an example, the engine, cooler and other attachments are the same as used in a PR724 crawler tractor and the inboard cylinders used in this first machine are from a LIEBHERR R924 crawler excavator – machines that can be found in the freezing cold in Russia as well as in desert conditions in North Africa. This means that millions of working hours of experience for these parts had previously been acquired and that the parts are subject to constant evaluation and improvement programmes.

For the larger bending machines (a 36 - 48 in., 48 - 60 in. and even a 60 - 80 in. are in the process of being built), the cylinders are the same as those used in LIEBHERR mining equipment, in what may be the toughest conditions in the world.

Simple and safe layout

The more parts there are on any machine, the more possibilities there are for defects. There is no reason for using more parts then necessary. So, as an example, on the 22 - 36 in., it was decided to use a single cylinder for the stiff back. LIEBHERR has in its range many different hydraulic cylinders and it was easy to find a size that would provide enough power and reach for the bending machine. This meant that a second cylinder was not required, so less cylinders, less hoses, less couplings and therefore less possible leaks.

But it is not only about the number of parts, the frame was designed in such way that extra steel plates or profiles to strengthen the frame in certain areas are obsolete, meaning less welding to be performed on the frame and a clear layout for the few hoses and hydraulic lines that are needed as a minimum.

One of the company's requirements was that all of its machines should be eligible for CE-marking, and therefore an extensive risk-assessment was carried out for the first machine. The design ensured that there are no high pressure hydraulic hoses in the operator area to make the operator's job safer. Through performing the risk assessment, however, more possible safety improvements were discovered.

The machine now has a wider, more stable and secure working area for the operator. The added safety lever ensures that there is no unwanted movement of the machine once an operator has stepped down from the stand. A rotating beacon has also been designed to show that the machine is in operation, as well as some sheet metal enclosures to avoid injuries to employees working on and around these powerful machines.

Easy service and repair

The previous two main requirements and the engineered solutions, almost automatically solved the third requirement. With the choice of using mainly standard LIEBHERR parts for the bending machine and by choosing a simple straightforward layout, service and repairs are made easy. As the equipment manufacturer has service points all over the world, there is almost always a local contact that can provide both service as actual service and spare parts. In the spare parts manuals, LIEBHERR parts numbers

Figure 3. An increasing number of projects use heavy wall pipe.

Figure 4. Flawless pipe bending, essential on any project.

are used and these can be ordered anywhere in the world and are delivered mostly within 48 hours. In addition, if any affiliated technician, anywhere in the world opens the engine covers, they will immediately recognise the engine and attachments.

Together with all documents that are required for obtaining the CE-mark, the machine hides no secrets from the operator, owner or the local service organisation, making this a bending machine with a truly global service network.

Lifecycle

Fulfilling all of the above requirements, Maats' bending machine does not come cheap. Although it is not more expensive than comparable machines, the company has a different philosophy. As stated before, the lifecycle of a bending machine can easily be up to 30 or 35 years, and Maats thinks it is just as important to have parts available in the 10th year, as well as in the 20th year of operation. It is not only about parts, bending sets should also be widely available, making it possible to use the machine to its full potential throughout its lifecycle.

Conclusion

Quality comes at a price. However, by keeping the parts to a minimum, by providing extensive and excellent global service and because of a guaranteed availability of parts servicing the bending machine throughout its lifecycle, this most probably is the least expensive option for those who think ahead, like Maats. WP