Injections are Serious Business

“Hydraulic injection injuries are very rare,” says Scott Kane, Parker Hannifin Corp. “For that reason, most doctors and emergency rooms do not know how to treat them. That is the problem. You can’t just give the guy some antibiotics, put ice on it and send him home.”

Dennis Kemper, Gates Corp., explains, “This could be one of the most serious types of injury a worker can encounter. Immediate medical help is required to try to avoid the loss of a limb or even worse. Try to keep the worker as calm as possible, lay them down and keep movement to a minimum. There is little anyone but a trained medical person can do, so get help and keep them calm.”

If you think you have been injected, seek immediate assistance. The injury often looks like a small pinhole. “And it doesn’t really hurt a lot at first,” says Kane. “So there are all of these tough guys that say I will be just fine. Don’t try to be a tough guy. The first 24 hours are critical. If you can get the injury treated within 24 hours, the chances of amputation are drastically reduced.”

Kane suggests keeping two web-site addresses handy in case of an injection injury. These include www.handsurgery.org, sponsored by the American Association for Hand Surgery, and www.assh.org, which is run by the American Society for Surgery of the Hand. These web sites will allow you to rapidly look up hand clinics by zip code.

Use Caution Under Pressure

Many incidents that occur when working on mobile hydraulic machinery are careless accidents, such as slips and falls. “Fortunately, you don’t hear a lot about the hydraulic injuries,” says Scott Kane, global platform manager - mobile, Parker Hannifin Corp. “But when they do occur, they are very severe.”

Hydraulic injuries occur mainly due to the failure to relieve pressure prior to working on a hydraulic system. “It is guys disconnecting a hose or cracking a seal... while there is still pressure in the system. Then they end up getting sprayed,” says Kane.

A lot of potential energy is stored in the hydraulic system. According to Dennis Kemper, account application engineer, Gates Corp., hydrostatic systems can produce pressures as high as 8,000 psi and temperatures up to 250°F. Work groups can generate pressures up to 4,000 psi and temperatures up to 212°F. Drain or return line hoses don’t have much pressure, but still have temperatures up to 275°F.

A ruptured hose releases this energy. “Unless you have ever seen a hydraulic hose rupture under 5,000 psi, you have no idea what kind of potential energy is there,” says Kane. “People take it for granted.”

There is also the possibility for serious burns. “Allow the system to cool to ambient temperature before performing any work on it,” advises Raymond Wilkins, chief engineer, fluid conveyance, Eaton’s Hydraulics Operations.

Because of the potential risks, technicians need to be qualified. “Repair personnel should be trained in safety procedures specific to hydraulics before working on hydraulic systems,” says Wilkins.

Safety basics

According to Wilkins, the most generic safety procedures include ensuring cylinder-supported machine components have been blocked and/or properly restrained, then pressure relieved from the system and all cylinders, in accordance with applicable safety standards and practices. “Exactly how these steps are accomplished depends on the details of the particular system being repaired, and should be spelled out in detail in the OEM repair manual and written procedures for the equipment in question,” he adds.

It’s critical to avoid shortcuts. For example, Kane notes that most manufacturers of cylinders for mobile applications incorporate a counterbalance valve. The function of the valve is to prevent the cylinder from dropping if the hose breaks. “That counterbalance valve holds everything out,” he states.

But the valve is not intended to be relied on as a lockout device. “I have seen guys who have the cylinder in a raised position, and when they do maintenance, they will assume the counterbalance valve will hold the cylinder up,” Kane comments. “I am not going to stick my head in there and rely on a counterbalance valve. If you have to have something extended, block it, chain it, pin it up.”

Watch for clues

Hydraulic hoses often give you visual clues of impending failure. “Cover abrasion, a cracked or missing rubber cover, bent or kinked hose, oily wet hose cover and blistered cover are all signs of hose damage that may lead to failure,” says Wilkins.

Of course, it isn’t possible to spot all potential failures. “The obvious problems — wear or slight leaks — are
easy to identify, but some of the fail-
ures are from within,” says Kemper.
“Pinholes or bursts occur because of
wear of the wire or due to a bend too
close to the stem. You will never see
them until the hose fails.”
This places an emphasis on pre-
ventative maintenance. “Hose assem-
bles can last a long time but not
indefinitely, so a regular PM program
is needed,” says Kemper. “We have
seen people try to use hoses for 15
years or more. While they got away
with it, others were not so lucky, and
that is when serious injuries occur.

“Hose is an elastomeric product,”
Kane adds. “It is like a belt on your
car. It is going to wear out.”

During a routine inspection of
the hoses, Kemper recommends look-
ning for high abrasion or wear. Tight
bends that exceed the minimum
bend radius recommended by the
hose assembly manufacturer; and
areas where the hose is bent quickly
from the stem. This could cause pin-
holes and premature failures.

Dust can also help identify leaks.
“It is an accepted practice to look for
collections of oily dirt or dust, which
may indicate a leak,” says Wilkins.

Safe inspection practices
Create a checklist for daily
walkarounds. “A generic checklist
should certainly include a visual
inspection — with appropriate eye
protection in place – for leaks,
damaged hoses and components,
twisted hose assemblies and rusted
or corroded fittings and adapters,”
says Wilkins. “These checks, and any
others that may be required, should
be performed with the system prop-
erly restrained, unpressurized and at
ambient temperature following the
approved procedure.”

If a leak is suspected, Wilkins
recommends washing and drying
the suspected location, then cover-
ing it with a paper towel or clean rag
secured so it will not be displaced or
drawn into the system. Re-pressurize
the system, then visually examine the
paper towel or rag periodically for
evidence of leaks, while wearing the
appropriate eye protection.

“DO NOT under any circum-
stances place hands or any other part
of your body on or near a suspected
leak location while the system is
pressurized,” Wilkins emphasizes.

Before conducting any actual
repairs, it is critical to relieve all
pressure in the system.

“Make sure all of the hydraulic
circuits are at rest,” says Kane.
“If it is a front-end loader, make
sure the bucket is on the
ground. If it is a back-
hoe, make
sure the backhoe is down. Most
pieces of mobile equipment will have
gauges in the system. Make sure they
all read zero. But even in that case,
you can’t be 100% sure that there is
no pressure in the system.”

If there is an accumulator in
the system, the pressure must be relieved.
“Most basic step is to read and
follow the manufacturer’s instruc-
tions for properly relieving any pres-
sure that may be present in the accu-
mulator,” says Wilkins. “Remember
that both sides of an accumulator
are under pressure. Draining the
fluid side does not relieve pressure
on the gas side.”

Proper hose assem-
ly replacement
Building hose assemblies is a
task that should not be entrusted to
just anyone. “People who think they
can make a hose because they can
crip it are sadly mistaken,” says Lee
Keddie, general manager, HKX Inc., a
manufacturer of auxiliary hydraulic
kits. “[At HKX], we are pretty particu-
lar about who makes the hose assem-
bly. We have the hose manufacturer
build our assemblies as much as possi-
able, and utilize their factory trained
distributors for small rush orders. We
feel the same way out in the field — it
must be by certified technicians.”

“Considering the safety implica-
tions, potential for environmental
damage and cost associated with
improperly assembled hoses, the
assembly technician must be well
trained in the procedures and equip-
ment used,” Wilkins agrees.

Certified technicians will under-
stand the importance of using the
correct combinations of hose and
couplings, crimp dies and crimp
settings, Kemper points out. “Most
experienced equipment manufac-
turers understand this,” he states.
“It is not as well understood by the
general public, which probably does
not know the background for the
development of crimp specs, such as
impulse performance.

“It is critical to use the right com-
bination of hose and couplings,” he
adds. “Mixing one manufacturer’s
couplings with another manufactur-
er’s hose can cause catastrophic fail-
ures, such as a coupler blowing off.”

“They really are a paired compo-
nent,” Keddie agrees. “There’s a lot
of technology involved in the gripping
of the hose to the stem and ferrule.”
Hose needs to be replaced with
an equivalent or better product. “Almost
every manufacturer prints their
information on the lay line of the
hose,” says Kane. “If you can’t read
what is on the lay line, most of the
hose replacement stores can cut the
hose in half and determine the hose
that you need.”

In addition, make sure replace-
ment parts are with OEM-spec
components. “We standardize on an
ISO-approved O-ring face seal and
four-bolt flange system,” says Keddie.
“A lot of people who do work in the
field might use JIC, as an example,
but that is not rated for the current
pressures of 5,000 psi.”

Be sure you properly torque
coupler system connections. “We
do specify torque values. However,
we hardly ever see an installer with a
torque wrench. We also supply them
with a system called Flats
from Wrench Resistance (FFWR),”
Keddie points out. Basically, once
the installer feels a resistance on the
wrench, the degrees of rotation are
specified in relation to the six flat
faces of the nut; for example, it may
specify that you turn it so the nut
rotates 1/4 to 1/2 FFWR.

“In some cases, this is more accu-
rately than a torque wrench since it
is independent of joint lubrication,”
Keddie asserts. “The one challenge
of the O-ring face seal is you can fin-
ter tighten it and if you don’t torque
it, the seal will work for a certain
period of time before it will leak.
The JIC will just not seal if you don’t
torque it.”

To ensure nuts do get tight-
ened properly, Keddie proposes a
methodical approach. “We recom-
mend that when you assemble the
systems, you put a dot on the face of
the nut after you have verified the
O-ring is properly seated. Then
when you actually torque the fit-
ting, put a line across it to the fit-
ting that is attached to,” he advis-
es. “That is a best practice.”

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