JOY Proximity Philosophy

Working to improve operator habits

A Long Process

Jointly developed a system with Massey/MSHA/Nautilus 4-5 years ago

Led to one of first MSHA approved systems

Partnered with Matrix in 2009 to develop a better solution for continuous miners

Functions as a Training Aid

Goal is to teach safe operator habits

System Reliability is Critical

No system will be accepted or used effectively if it’s not reliable

An unreliable system does not improve operator safety

Limitations

All electro-magnetic based systems are subject to potential interference from other sources – ie. Coiled trailing cable, large metal objects, power centers
System Experience

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**Field Installations**

30+ machines currently operating at various mines (first shipped Oct 2009)


Systems operating with variety of batch and continuous haulage systems

**SMARTZONE Prox-Ready**

New machines shipped from Joy beginning **November 2010**, **rebuilds** beginning **November 2011**

Includes integrated receiver mounts, controller enclosure, and basic cabling

Allows for underground installation at a later date

**Full System Release**

**Q4 2011 following successful field trials**
Critical Success Factors

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Proper Installation & System Protection

- Promotes operator acceptance, ensures continued use
- Limits system failures due to damage

Proper Training

- Promotes operator acceptance
- Limits system downtime through proper troubleshooting

Understanding Technology Limitations

- End users made aware these *systems are not fail safe*
- Drives operator awareness through understanding
Success Factors

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Proper Installation & System Protection

Six receiver mounts located around the machine

Substantial fabrication work required

Ref.p44 “proper functioning..is directly related to the quality of the installation...”
Rule Considerations

*Rebuild capacity will prohibit implementation timeline*

75.1732a *Machines covered.*

Machines currently in operation - 18 months to comply

Proper Installation & System Protection

Requires multiple shifts of cutting & welding

Must be completed in a workshop to ensure proper protection

Example

\[
\begin{align*}
1150 & \text{ Current US operating fleet} \\
\div & \text{ 18 Months to comply} \\
\times & 64 \text{ Machine installations per month required}
\end{align*}
\]

*Note: Joy typically rebuilds 11 machines per month*
Rule Considerations

Rebuild capacity will prohibit implementation timeline

75.1732a Machines covered.
Machines currently in operation - 18 months to comply

Proper Installation & System Protection
Requires multiple shifts of cutting & welding
Must be completed in a workshop to ensure proper protection

Example: Based on 2010 MSHA recorded tons by region

<table>
<thead>
<tr>
<th>Region</th>
<th>N.App</th>
<th>Central App</th>
<th>S.App</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tons/Rebuild</td>
<td>1,500,000</td>
<td>1,500,000</td>
<td>1,500,000</td>
</tr>
<tr>
<td>Avg. Tons/Month/Mine</td>
<td>41,086</td>
<td>29,779</td>
<td>30,109</td>
</tr>
<tr>
<td>Avg. Months Between Rebuild</td>
<td>36.5</td>
<td>50.4</td>
<td>49.8</td>
</tr>
</tbody>
</table>

Note: Mines with less than 50,000 annual tons excluded from calculations
Rule Considerations

Training capacity will prohibit implementation timeline

75.1732a Machines covered.

Machines currently in operation - 18 months to comply

Proper Training & System Verification

Minimum 3 days training per installation

Insufficient training will be detrimental to both maintenance and operation

Example

1150  Current US operating fleet

÷  18  Months to comply

64  Machine installations per month required

x  3  Man days of training per machine

192  Man days of training required per month

Note: Joy’s typical capacity is 30 man days per month
Rule Considerations

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75.1732b(1)(ii) Requirements

- Machine must stop no closer than 3 feet from a miner
- When cutting, machine must stop before contacting operator

Current Technology is Not Fail Safe

- Impossible to prevent contact in all cases, environment will determine stopping distance
- Current technology is sufficient for training, not safety system
- Zones should not require operator positioning in hazardous locations

Tram Mode

Cutting Mode
Rule Considerations

*Working to improve operator habits*

75.1732b(1)(ii) Requirements

- Machine must stop no closer than 3 feet from a miner
- Ref p.33 comments: “all machine movement be stopped”

Alternate Proposals

- Shutdown process to begin at 3’, final machine position depends on environment
- Only prohibit functions which cause machine motion, tram and conveyor swing
- Allow zone configuration that keep operators away from haulage

![Tram Mode](image1.png)  ![Cutting Mode](image2.png)
Rule Considerations

*Working to improve operator habits*

75.1732b(5) Requirements

- Prevent interference with or from other electrical systems

**Current Technology is Not Fail Safe**

- Electromagnetic based systems are influenced by other systems
- Examples include coiled trailing cable, large metal objects, power centers