

Mechanical Engineering Safety Seminar

Competence of Maintenance People – An Industry Perspective

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HowCarsareRecoveredin1.ppsx

The Hitachi logo is displayed in a bold, red, sans-serif font. It is positioned in the bottom right corner of the slide, above a thick orange horizontal bar that spans the width of the slide.

*How Cars are Recovered in
Ireland*

The Murphy's Law Story

or

*How to Compound a
Catastrophe*



“Hey Paddy, we’ve got dis here car ta pull out.”



*“Shamus, we’re pullin’ it up
now.”*



*“Here Paddy, what happens if da crane can’t hold it?”
“Shamus me lad, don’t you even tink about dat
happening.”*



“Hoy Paddy, oi didn’t even tink it, oh shoit!”



“Shamus, moi boy, go get a bigga crane.”
“Alroight, Paddy.”



“Ah Shamus, dis bigga crane is doin’ da job well.”



“Dat it is Paddy, dat it is.”



“Now for da first crane Shamus, up it cooms.”



“ What's happening Paddy, what's happening.”



“Oh!! Shamus, we’ve got ta get an even bigga crane!”

“ Theory and experience are of equal value to the engineer.

Theory without experience is the foundation without the superstructure.

Experience without the theory is the superstructure without the foundation.

The former is useless, the latter dangerous”

William Charles Kernot

Australia's first Professor of Engineering, The University of Melbourne,
1883 - 1909

Competency - Definition

- The ability to perform activities in an occupational category or function to the standard expected in employment.

Combination of:

- Knowledge
- Experience
- Enterprise

From capable to competent -

- We have capable people equipped with the knowledge and skills to perform occupational tasks.
- Enterprise is the ability to **engage** with new challenges and different circumstances.
- Competent engineers, tradespeople, operators, managers **engage** with the new and help shape the future.
- Competent personnel are those who do it satisfactorily and consistently.

Essential Trade Knowledge

- Technical training TAFE/RTO's
- Range of accredited courses
- Expect basic skill levels in repair and maintenance
- Specific product training for organisations
- Literacy and numeracy
- Life skills

Engineering and Trade Theory

- Time
- Weight, Mass
- Measurement and testing
- Fits and tolerances
- Temperature
- Pressure, Flow, Force, Torque
- Displacement, speed, acceleration
- Current, Voltage
- Work and Energy
- Materials
- Manufacturing Techniques

Industry challenges to competency

- Shortage of skilled trades personnel to impart knowledge to trainees and apprentices.
- Low numbers of apprentices in training.
- Large training organisations have reduced apprentice intakes BHP, State Rail, Electrical Generators and others traditionally these all had a high level of base trade and engineering focus
- Large heavy equipment experience
- Modern equipment “blackbox technology”
- Diagnosis by replacement philosophy.
- Reluctance to measure and test, let alone report with confidence.

Challenges to competency

- Strong emphasis on completion or passing of training modules.
- Focus must be on learning and understanding the principles as applied at the work site.
- Computer age, instantaneous results
- It takes too long to pay attention to the detail, stop, think, ask questions **Engage**

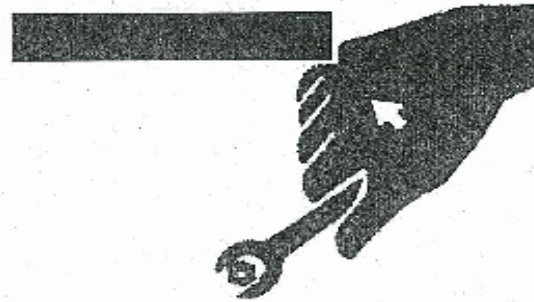
Systems of Work – Engineering Standards

- Management Systems
- Competent Personnel
- Specific Training Modules
- Safe Work Method Statements
- Written Procedures/Manuals
- Perform work to a standard
- Check work to a standard
- Our Quality Assurance and Safety Systems eliminate problems associated with competency!!!

GENERAL / Tightening

TORQUE CHART

⚠ CAUTION: Use tools appropriate for the work to be done. Makeshift tools and procedures can create safety hazards. For loosening and tightening nuts and bolts, use correct size tools. Otherwise, tightening tools may slip, potentially causing personal injury.



Bolt Types

Tighten nuts or bolts correctly to torque specifications. Four different types and grades of bolt are employed. Make sure to employ correct bolts and tighten them correctly when assembling the machine or components.

Specified Tightening Torque Chart

Bolt Dia.	Wrench Size	Hexagon Wrench Size	Socket Bolt			Hex Bolt			Hex Nut		
			N·m	(kgf·m)	(lbf·ft)	N·m	(kgf·m)	(lbf·ft)	N·m	(kgf·m)	(lbf·ft)
M6	12	6	30	(3.1)	(22)	20	(2.0)	(15.0)	10	(1.0)	(7.4)
M10	17	8	55	(5.6)	(48)	60	(6.1)	(57)	20	(2.0)	(15.0)
M12	19	10	110	(11.0)	(81)	90	(9.2)	(68)	35	(3.6)	(26.0)
M14	22	12	150	(15.5)	(135)	140	(14.0)	(103)	55	(5.6)	(41)
M16	24	14	270	(27.5)	(200)	210	(21.5)	(155)	80	(8.2)	(59)
M18	27	14	400	(41.0)	(295)	300	(30.5)	(220)	120	(12.0)	(89)
M20	30	17	550	(56.0)	(410)	400	(41.0)	(295)	170	(17.0)	(125)
M22	32	17	750	(76.5)	(550)	550	(56.0)	(410)	220	(22.5)	(162)
M24	36	19	850	(87.0)	(630)	700	(71.5)	(520)	260	(26.5)	(205)
M27	41	19	1400	(143)	(1030)	1050	(107)	(770)	400	(41.0)	(295)
M30	45	22	1950	(200)	(1440)	1450	(148)	(1070)	550	(56.0)	(410)

Bolt Dia	Wrench size	Across Flats	Grade 10.9			Grade 8.8		
			Nm	Kgf m	Lbf ft	Nm	Kgf m	Lbf ft
M20	30	17	550	56.0	410	400	41.0	295

HITACHI

FRONT-END ATTACHMENT ASSEMBLY CHECK SHEETS (3/7)

3. Hyd. hose connections for backhoe front



Report No. _____
SATISFACTORY
UNSATISFACTORY
CORRECTED

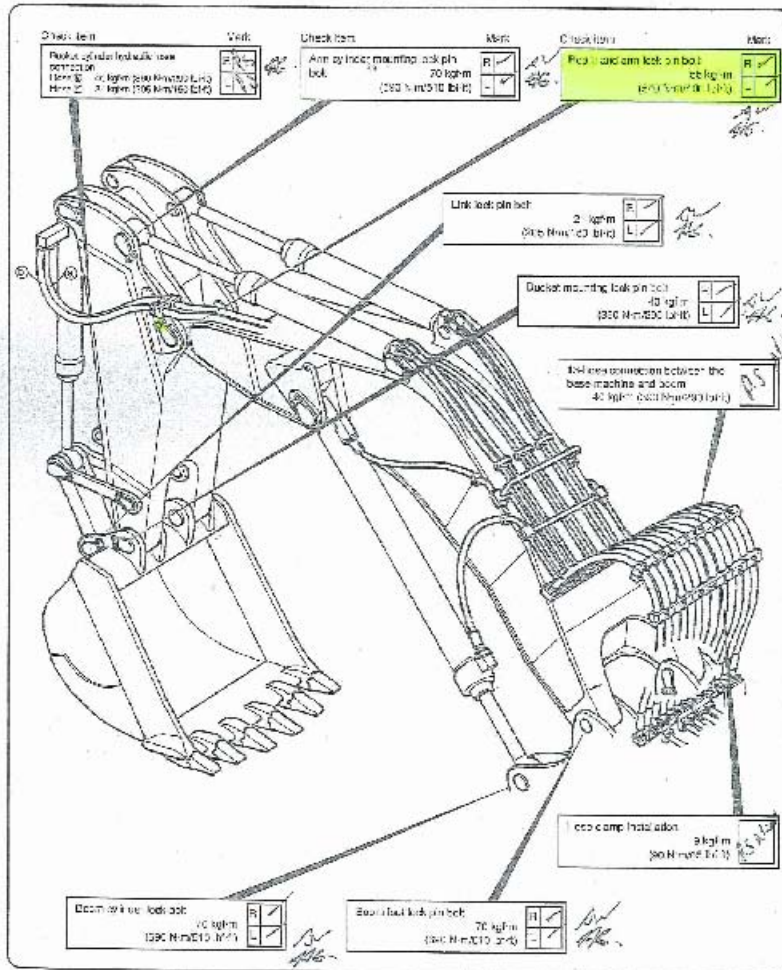
BACKHOE FRONT



CAPACITY	SERIAL NO.
Boom	
Arm	
Buckle	

Inspected by: _____

Front End Attachment - Factory assembly check sheets



Boom and arm lock pin
bolt torque 55 kgf m
(550Nm/400 lbf ft)

Basic Machine Assembly

- Factory specified tightening torque chart for different grade bolts.
- Specific Front End Attachment
 - Factory assembly check sheet:
 - Boom and arm lock pin bolt torque 55 kgf m (550Nm/400 lbf ft)



What do we do?

- Torque as per factory assembly check sheet diagram 550 Nm or to 400 Nm.
- Of course Grade 8.8 is 400 Nm
- Evidence of unquestionable reliance on written procedures
- Reluctance to question or apply a logical engineering approach to problem solving
- Written procedures are essential but the challenge is to have people **engaged** when they are using procedures and ask questions.

What can we do?

- Challenge the knowledge of the basics now
- Reinforce the theory through good communication and develop the understanding of engineering basics
- Overcome the unfamiliar and fear in technology
- Mentor to promote a learning environment.
- Ask a lot of questions, don't assume everyone knows
- Test the level of understanding
- Set the level of expectation

Coal Mine Health and Safety Regulation 2006

– Mechanical Engineering Management Plan

Clause 20

- Management plan for a coal operation must provide for the following:
- (a) Safe Operating & Environment Plan (SOEP) for mechanical plant and installations throughout their lifecycle to include:
 - a) **Competence** of people who may deal with plant and installations during the lifecycle of the plant at the coal operation
 - b) Arrangements for supervision of people installing, commissioning, maintaining and repairing mechanical plant to be undertaken by people with appropriate mechanical engineering **competence** or a qualified mechanical tradesperson.

Competency Assessment Methodology

- Show what has been achieved by the person in practice?
- Show how the person achieved and what interactions took place during the work that the person did.
- Show why the person made particular choices.
- Show how knowledge was acquired to enable the person to do the work.

Competency Assessment

- No alternative other than to incorporate competency assessment into day to day maintenance activities.
 - recognised prior learning
 - written assessment
 - demonstration, practical assessment

Thank you