

We put  
safety first



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# **THE INVESTIGATION INTO THE TESTING OF A CONVEYANCE IN AN OVERWIND CONDITION: ROPE CONNECTED**

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**Engineering Manager - Winders**

**19 April 2011**

# Agenda

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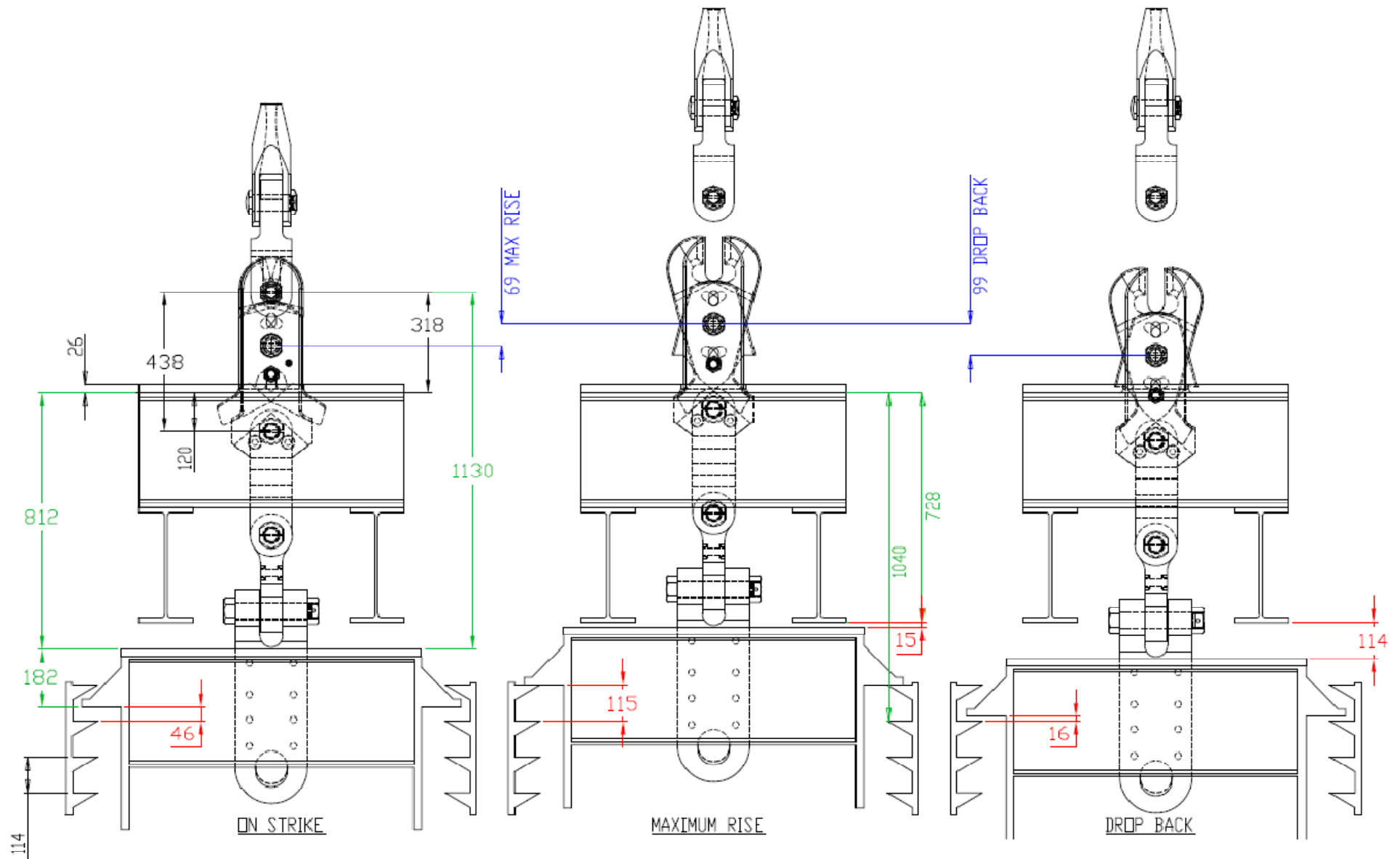
- **Overwind in headgear philosophy**
- **Stages in headgear for full detachment**
- **Overwind incidents 2010**
- **Overwind incidents 2011**
- **Jack Catch arrangement simulations**
- **Crash Beam arrangement simulations**
- **Detachment simulations**
- **Actual detachments and other findings**
- **Technical Specifications for detaching hooks**
- **Pre-check specifications**
- **Phase 1 tests before conveyance goes into headgear test**
- **Phase 2 test in headgear – Confirmation testing of phase 1 test results**
- **Questions**

# Overwind in headgear philosophy

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- **What is the overwind philosophy within your group?**
  - **Decide on a standard and conform**
- **Anglo Platinum**
  - **Spectacle plate is first defence**
  - **Jack catches is secondary defence with (absorption buffers)**

# Stages in headgear for full detachment



# Overwind incidents 2010

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- **Bokoni Rock winder**
  - Rectified long and short rope (vernier coupling not connected at correct point)
- **Impala Rock winder**
  - Full speed overwind
  - Blacks braking system (very old design)
- **Elandsrand Rock**
  - 4 m/s overwind
  - (still under investigation)
- **Kloof 4# sub vertical BMR rock**
  - Full speed overwind
  - Power failure (Winder needed to be Synchronized)
- **Driefontein 6 sub vertical rock**
  - 2.5 m/s overwind
  - Emergency brake valve solenoid failure (single line)
- **Kloof main East BMR rock**
  - 2.7 m/s into jack catches (rope not detached)
  - Done back ends (vernier coupling not disconnected)

# Overwind incidents 2011

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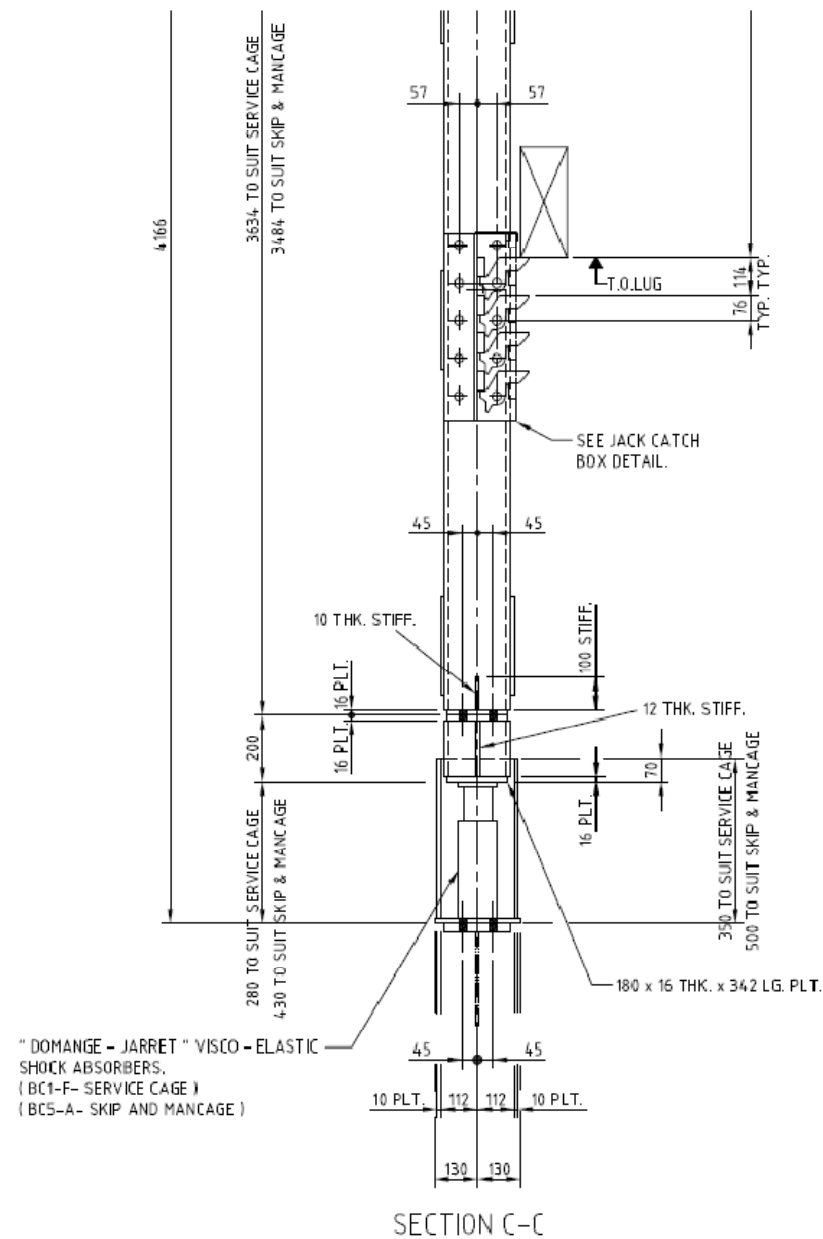
- **Amandelbult Material decline winder**
  - **Cutting of back end and vernier coupling not disconnected**

# Jack Catch arrangement simulations

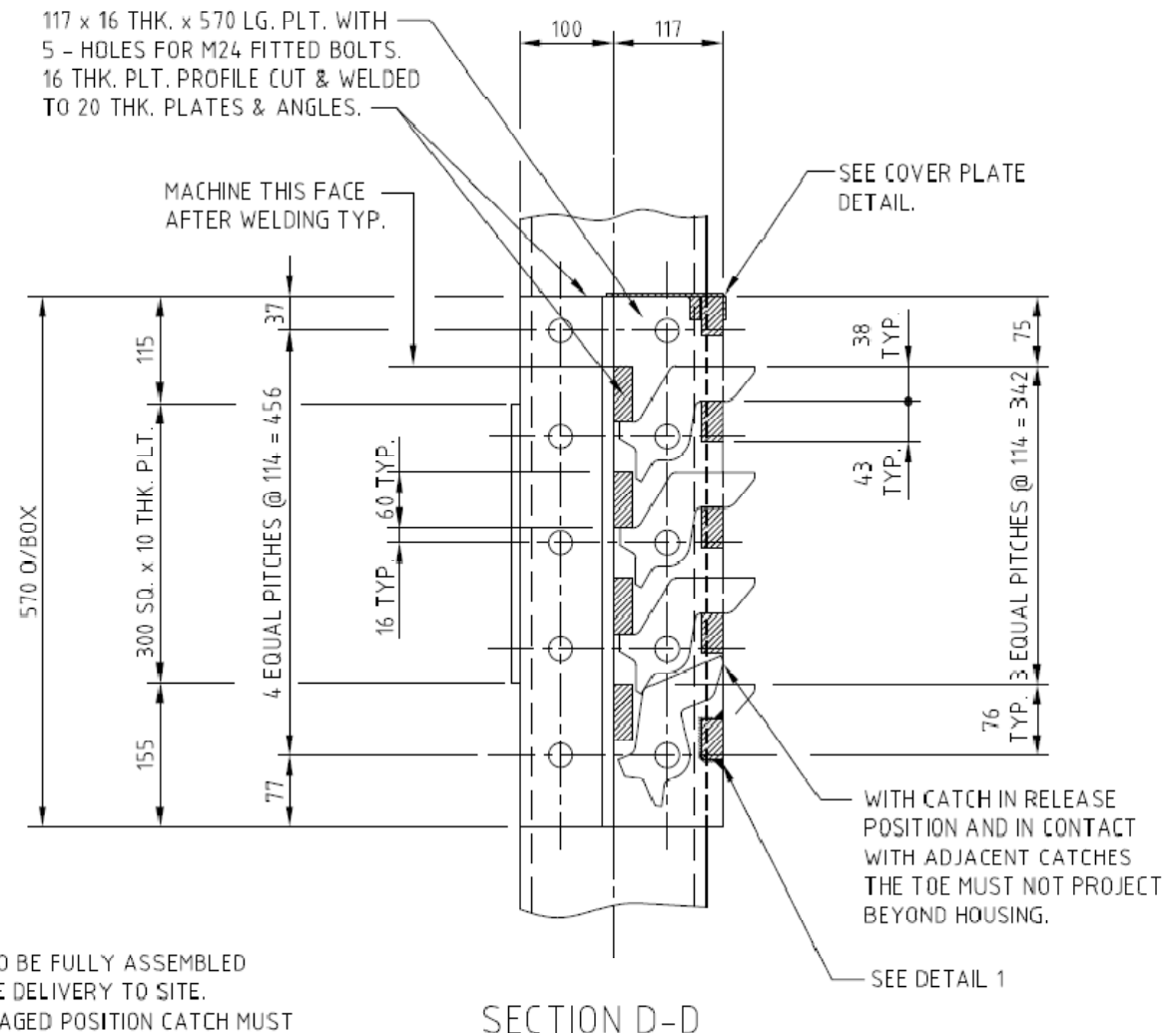
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- Jack Catches
  - Different designs
  - Jack catch spacing?
    - 114mm spacing for Stephens hook design
    - Rocket hook jack catch spacing?
  - One catch lug versus two catch lug philosophy
  - Shock absorption buffers
- 2D single lug jack catch
  - 2D single lug jack catch 1.avi
- 3D double lug jack catch
  - 2D double lug jack catch 2.avi
- 3D double lug jack catch lock up
  - 2D double Lug lockup.avi

# Jack catches and Jarret buffer assembly



# Jack catch detail



NOTE :-  
JACK CATCH BOX TO BE FULLY ASSEMBLED  
ASSEMBLED BEFORE DELIVERY TO SITE.  
WITH CATCH IN ENGAGED POSITION CATCH MUST  
NOT BEAR ON BOLT WHEN LOAD IS APPLIED.

JACK CATCH BOX DETAIL

12 - OFF REQD. AS DRAWN

# Crash Beam arrangement simulation

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- Crash beam
  - Different designs
- 2D crash beam wrong simulation
  - 2D crashbeam wrong.avi
- 3D double lug jack catch lock up
  - 3D crashbeam wrong.avi

# Detachment simulations

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- Detachment philosophies
  - Different designs?
- 2D Stephens detachment
  - [2D stephens detachment.avi](#)
- 3D Stephens detachment
  - [3D stephens detachment.avi](#)
- 2D Rocket detachment on jack catch
  - [2D rocket detachment 1.mpg](#)
- 2D Rocket detachment on catch plate
  - [2D rocket detachment 2.mpg](#)
- 3D Rocket detachment on catch plate
  - [3D rocket detachment 2.mpg](#)

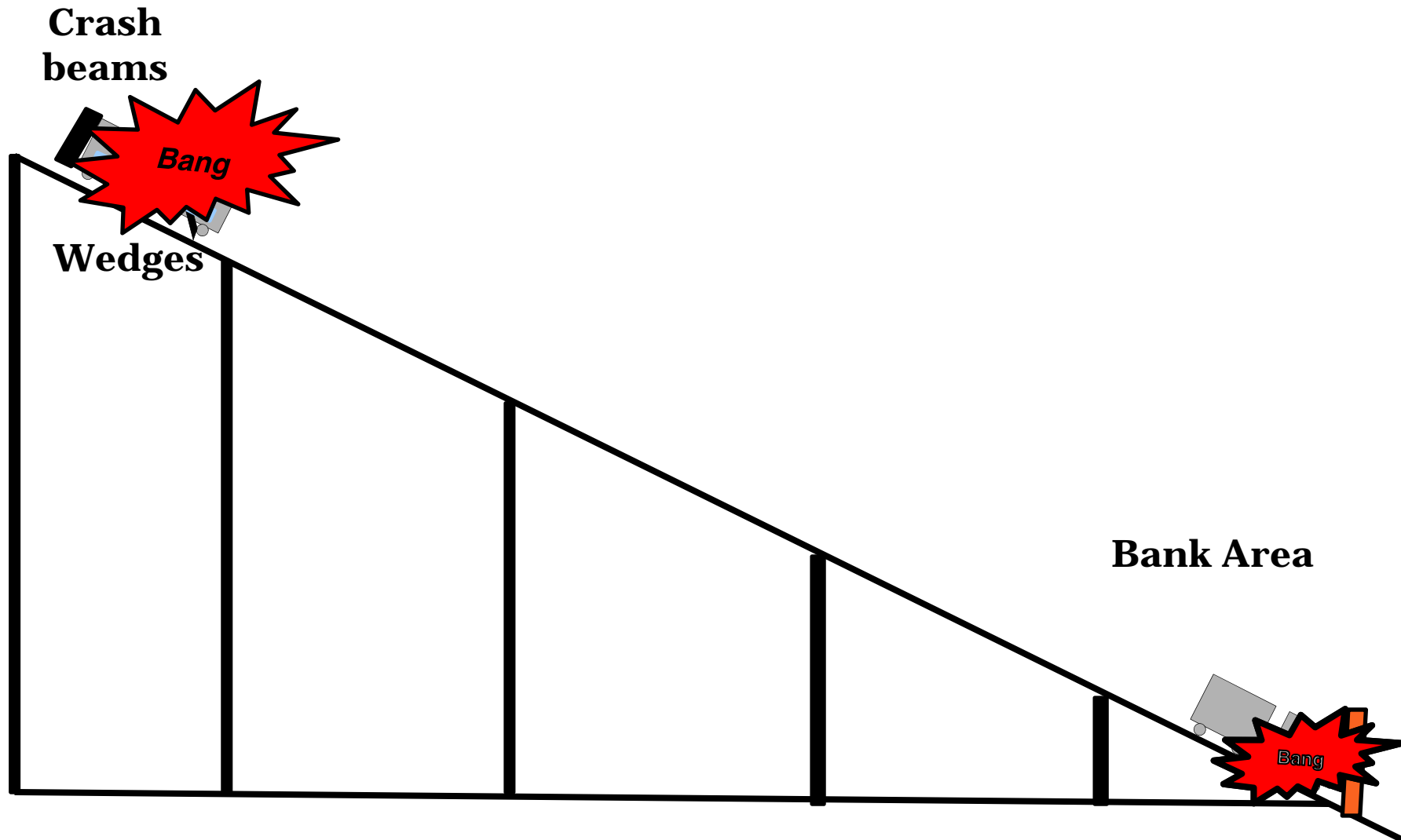
# Decline shaft incident - 2011

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- On Friday 21-01-2011 the engineering team at the decline winder planned to cut a 45m front-end
- At ± 12:45 pm the bell operator signaled the driver to remove bad coil from the drum
- The conveyances were pulled from the bank into the shaft, lowered a few turns and raised at full speed towards the headgear
- As the conveyances reached the top of the headgear the conveyance crashed into the crash beams which resulted in the rope disconnecting from the leading conveyance
- Both conveyances travelled down the headgear and crashed above the shaft opening

# Decline shaft overwind simulation

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# Decline shaft incident - 2011

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# Vertical shaft incident - 2010

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- Replaced rock winder ropes
- The next day a long and short rope condition was measured and the required length to be cut determined
- The underlay conveyance was hoisted to the bank and suspended and the task of cutting the rope was performed
- The underlay conveyance was hoisted to the tip position to set the overwind trips
- An overwind occurred when the underlay conveyance was hoisted past the tip position
- The rope dislodged and the conveyance was suspended in the jack catches

# Vertical shaft incident - 2010

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Skip Secured  
in Jack  
catches

The detached  
front end of  
the rope



Safety Detachment  
Hook in the open  
position



# Results of audits within Group

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**CRASH BEAMS IN LINE  
WITH TRANSOM**

# Results of audits within Group

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**NO CLEARANCE ON  
SPECTACLE PLATE FOR  
HUMBLE HOOK**

# Results of audits within Group

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**Possible obstruction of  
Humble hook into crash  
beams**

# Technical Specifications for detaching hooks

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- The detaching hook and its spectacle plate must conform to the manufacturer's specifications in so far as correct clearance between detaching hook body and spectacle plate hole and the correct thickness, taper and radius of the spectacle plate
- The duty and size of the detaching hook must conform to the Original Equipment Manufacturer's specification.
- The winding rope must be in the centre of the spectacle plate hole.
- The pitch (root clearance) of the jack catches and the conveyance lugs shall be compatible to ensure effective operation.
- The drop back distance of the conveyance onto the jack catches shall be not more than 75mm and not less than 25mm.
- The crash beam clearance at the prescribed lift on the humble hook shall be not more than 25mm and not less than 10mm.
- The positioning of the jack catches shall be such that they can be manually operated to allow the conveyance to be lowered out of the overwind position.

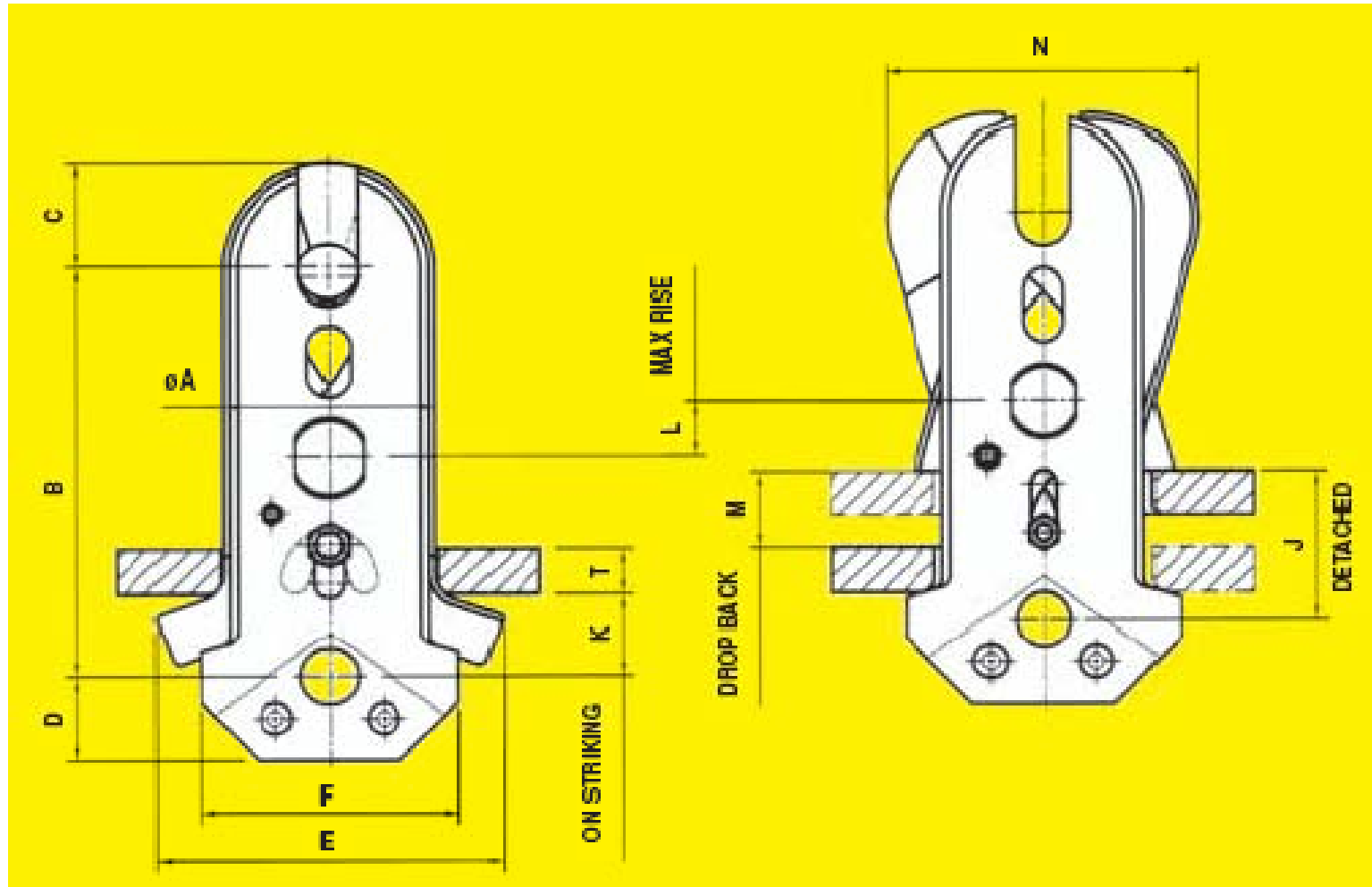
# Pre-check specifications

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- **The conveyance must be checked against the latest revision drawings to ensure that it complies, before the tests are carried out. Specific attention must be paid to the following;**
  - **Jack catch alignment with respect to guides to be checked in relation with the conveyance spectacle plate**
  - **The pitch (root clearance) between jack catches and conveyance lugs.**
  - **The correct humble hook with all the relevant links**
  - **Clearance of conveyance crosshead area that needs to enter the crash beams and spectacle plate for safe detachment.**
  - **Escape platforms to be checked**
  - **Radii on bottom of spectacle plate**
  - **Winder rope to run in middle of spectacle hole**
  - **Jack catches clearance.**
  - **Crash beam clearances**

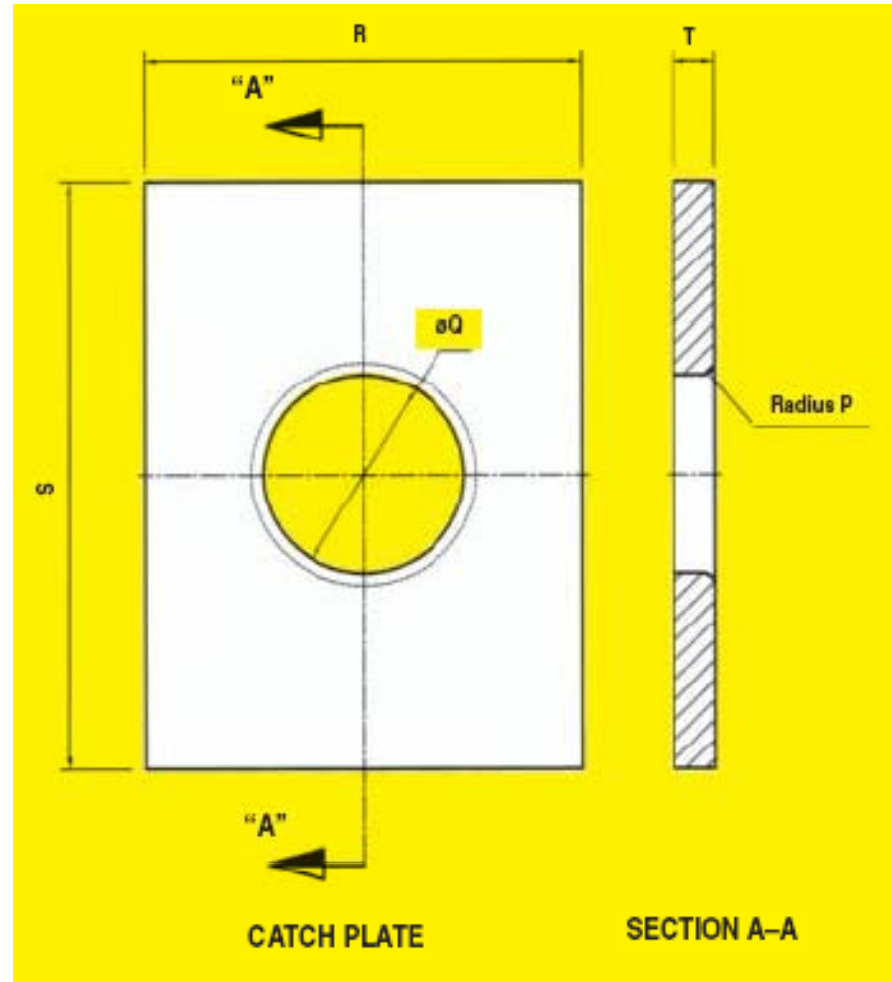
### 3 Step overwind sequence for Stephens humble hook

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# Spectacle plate specification

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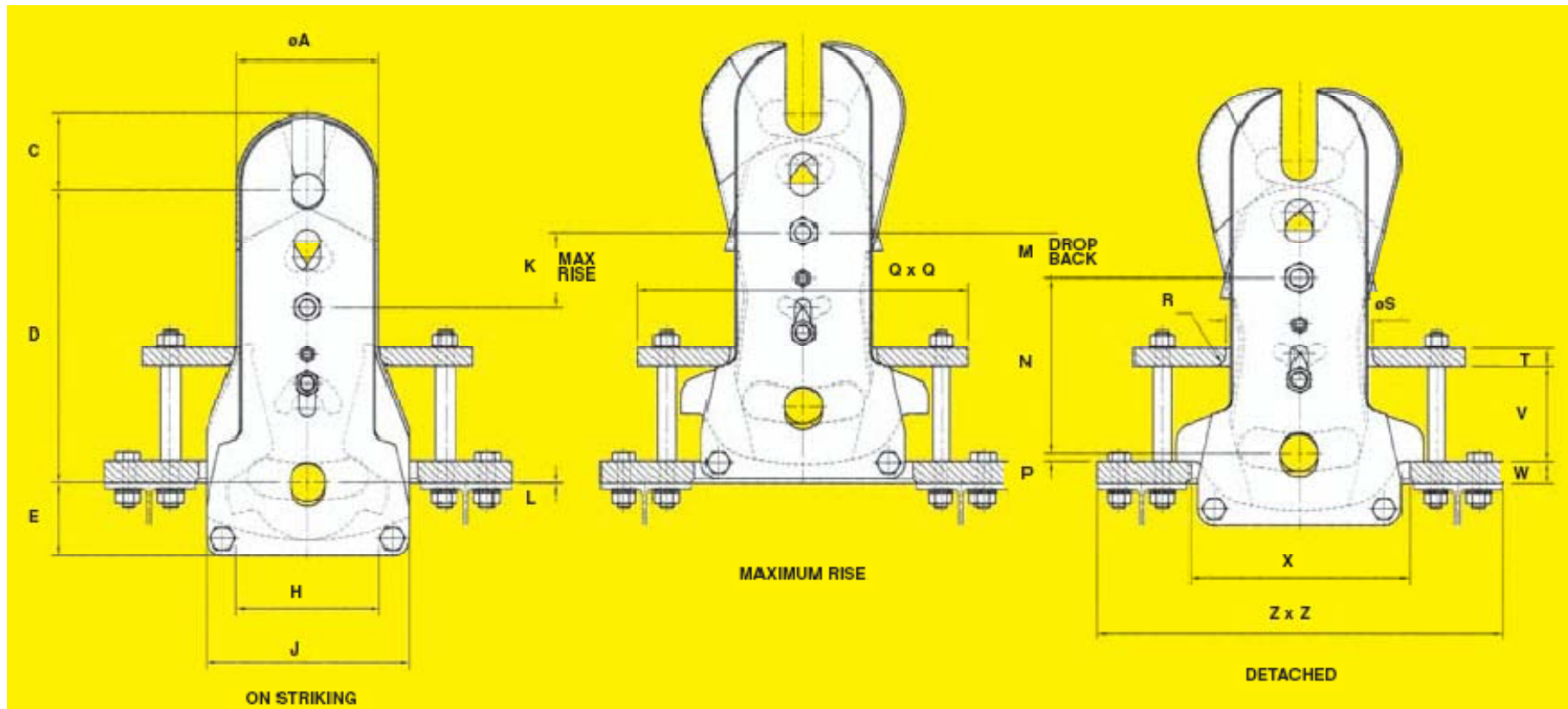
# Stephen humble hook table

Max rise

Drop back

TYPE	Safe Working Mass Load (tons)	Dimensions (mm)																		Appr. Mass (kg)
		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	
BH-3	3	114	295	70	59	213	150	58	33,3	120	78	45	65	182	9,5	118	460	760	22	20
BH-5	5	152	341	89	76	267	190	71	39,7	137	93	59	81	228	9,5	156	460	760	22	25
BH-7	7	178	382	102	74	302	210	80	46	168	92	52	102	260	9,5	182	530	840	26	50
BH-9	9	204	439	114	86	343	250	96	52,4	172	117	69	99	280	13	208	610	840	26	90
BH-12	12	254	434	127	100	387	300	106	58,7	164	94	60	98	346	13	260	680	910	32	115
BH-15	15	254	455	137	100	392	300	131	63,5	163	97	59	93	362	13	260	680	910	32	140
BH-20	20	305	589	152	121	494	370	153	79,4	216	118	79	112	446	19	312	680	910	65	246
BH-24	24	330	597	165	127	526	390	172	85,7	261	155	83	124	454	19	336	712	940	65	390
BH-30	30	356	645	178	133	540	420	185	95,3	276	163	105	153	514	22	362	750	990	65	443
BH-35	35	356	658	178	133	560	420	205	102	300	178	114	161	492	38	362	750	990	75	470

# 3 step overwind sequence for Rocket humble hook



# Rocket humble hook table

Max rise

Drop back

Type	Safe Working Mass Load (Tons)	Dimensions (mm)																				Appr. Mass (kg)	
		A	B	C	D	E	F	G	H	J	K	M	N	P	Q	R	S	T	V	W	X		
BR-5	5	178	76	99	386	90	44	48	185	270	80	60	234	5	500	16	181	25	120	30	290	650	60
BR-10	10	254	100	137	567	146	57	60	250	370	136	104	335	7	600	22	259	30	175	38	395	800	160
BR-15	15	304	115	162	624	151	70	76	305	430	162	98	372	17	700	25	311	40	200	50	430	860	240
BR-20	20	304	140	162	634	156	83	86	315	440	140	69	372	14	750	32	311	50	173	63	470	900	285
BR-25	25	330	156	180	694	127	86	90	365	500	122	110	402	40	800	35	338	55	240	70	530	1000	330
BR-30	30	356	160	193	741	160	93	96	385	540	150	90	418	51	860	35	364	60	255	75	575	1070	380

# Phase 1 tests before conveyance goes into headgear test

Mine: khuseleka

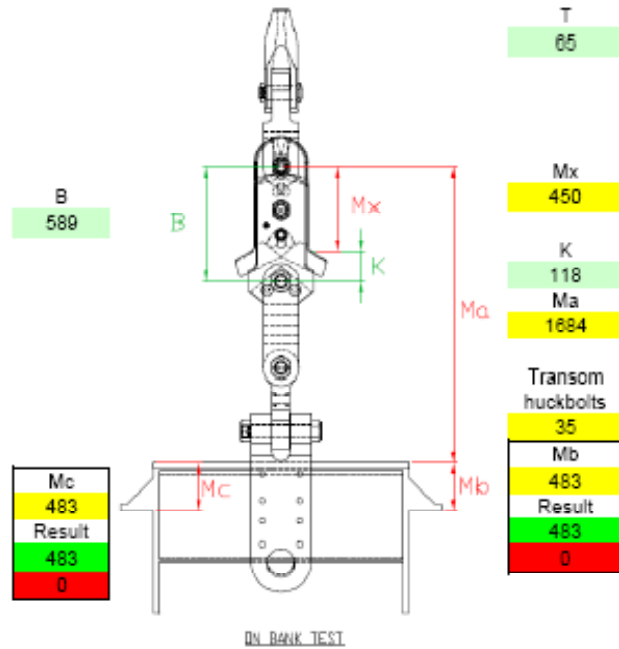
Type:

Man u/lay

Date: 2010/09/15

Type: Stephen

Mass: 20



Mc
483
Result
483
0

T
65

Md
65

Mx
450

Me
1800

K
118

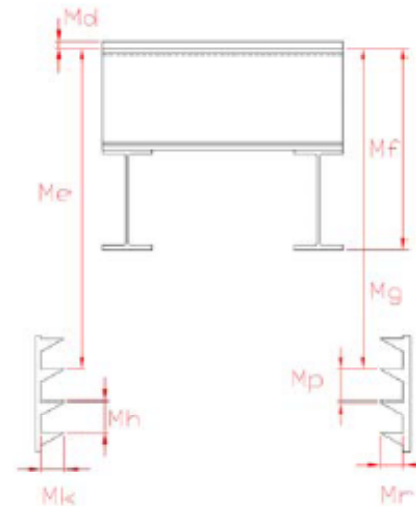
Ma
1684

Transom huckbolts
35

Mb
483

Result
483

0
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Mf
1105
Result
1105
0

Mg
1800

Mp
115

Mr
50

From OEM Table

B	589
K	118
L	79
M	112
T	65

Mx check
471

T Check
65

## PRELIMINARY TESTS ON BANK

Jack catch drop-back clearance

Left	Right	
50	50	25mm - 75mm

Crash beam min clearance

15	15	10mm - 25mm
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Left lug on conveyance correction

0

Right lug on conveyance correction

0

Crash beam correction

0

# Phase 2 test in headgear – Confirmation testing of phase 1 test results

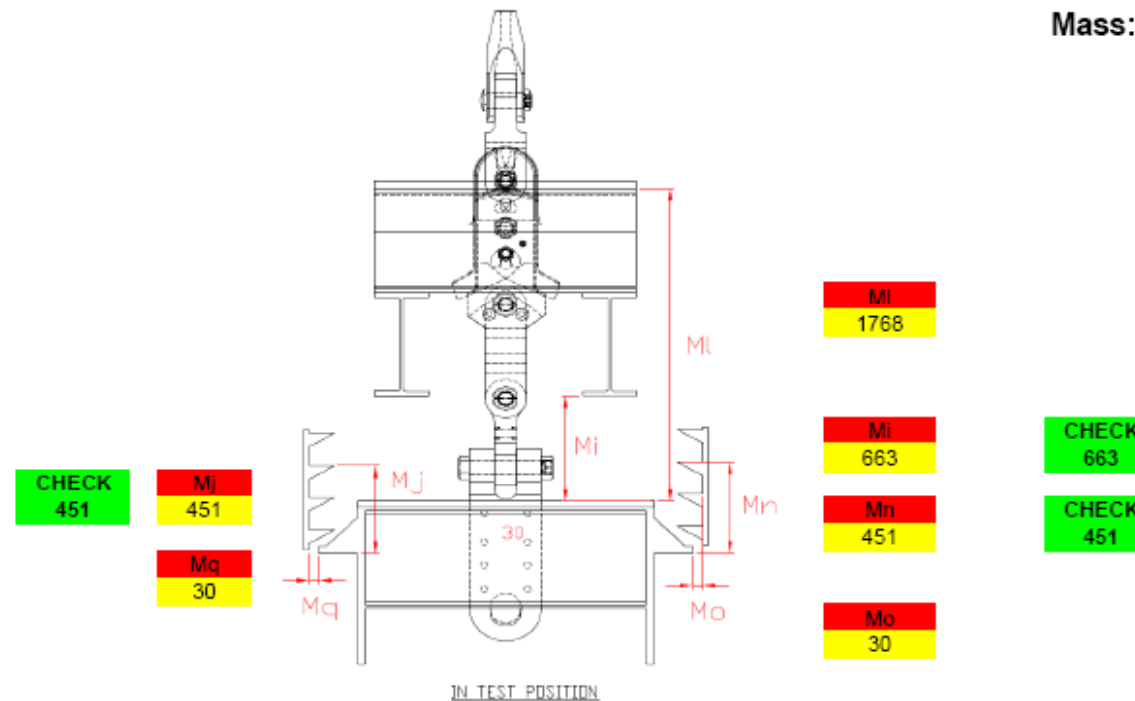
Mine: khuseleka

Type: Man u/lay

Date: 2010/09/15

Type: Stephen

Mass: 20



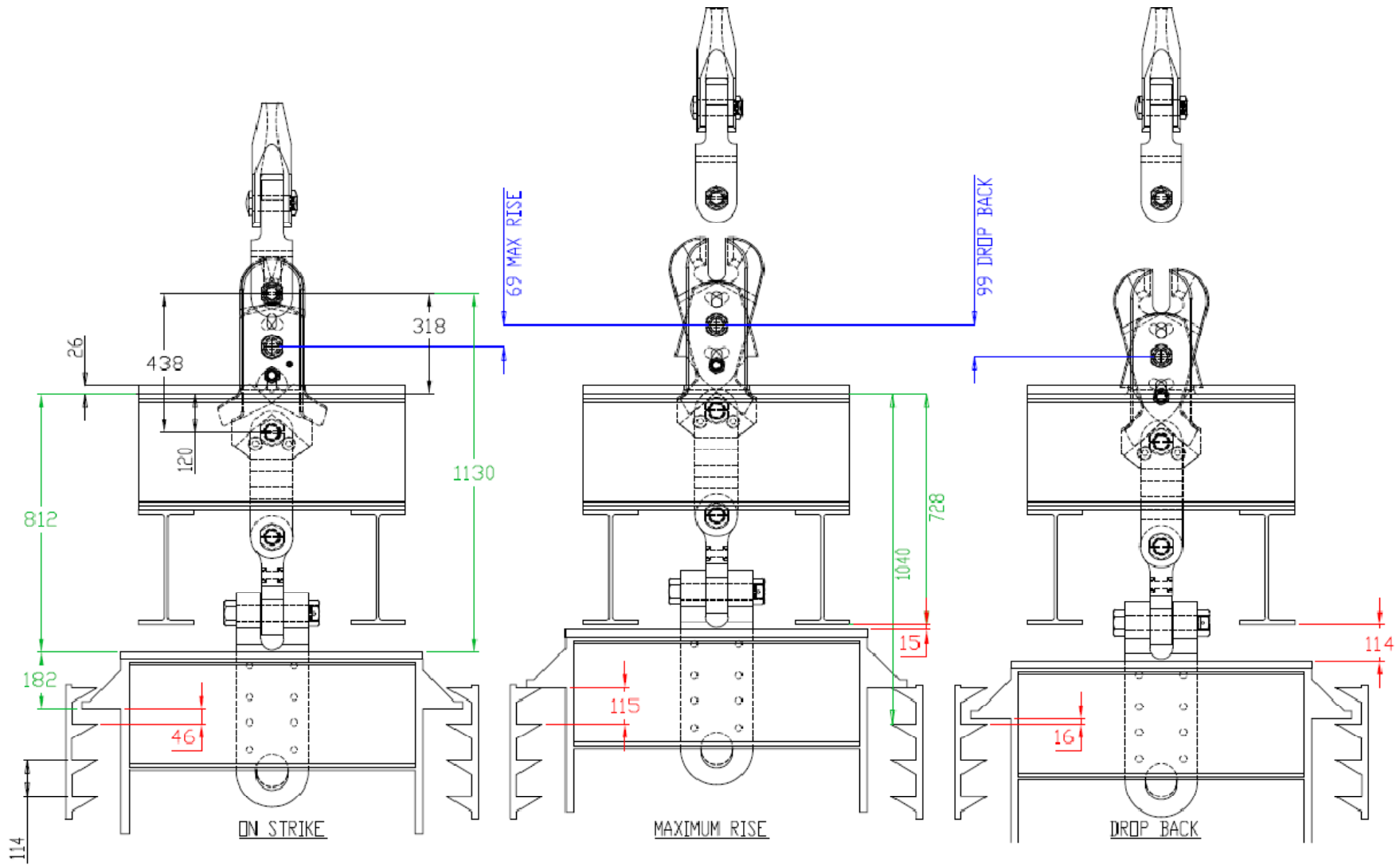
## PRELIMINARY TESTS ON BANK

	Left	Right	
Jack catch drop-back clearance	50	50	25mm - 75mm
Crash beam min clearance	15	15	10mm - 25mm

## CONFIRMATION OF FINAL MEASUREMENTS WITH CONVEYANCE IN HEADGEAR

Jack catch drop-back clearance	50	50	25mm - 75mm
Crash beam min clearance	15	15	10mm - 25mm
Jack catch contact clearance	40%	40%	40% - 60%

# Example of actual measurements



# Questions

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