ASSEMBLY NOTES
MACHINE NO 3
MINNEAPOLIS
Fitting of valves

In the course of changing the panel arrang in the housing, it turned out that the valve stem extensions would interfere with the 12mm inner panel owing to the hole now being 13φ instead of the large hole in the inner 5mm panel in No.142 machines. This can be fixed by tapering the valve stem extensions and tapping the hole as shown.

We now have 8mm of travel of the valve stem, more than enough, and there is still substantial protection.
Tapered to 66.970 further in
0.005 out of round

10/5/91:
checked internal
micrometer 66.995 in 66.998 standard
— micrometer OK to couple better
cool.

re-measured: 66.980, 975 within spec

Clipped external micrometer — OK except test bar a bit cold, so
external measurements could be a few pm under.

10 . 70 . 5
350 . 10
335 . 10
Dimensions as received:

3101 Top plug: OD 66.980
   ID 30.014

3102 Top piston: OD 29.985
   Piston extensions: 14.985; 14.990
   Lower " " 14.990

4101 Bottom plug: OD overall area 66.988
   OD 1/2C " 64.940
   ID " " 58.010
   OD big end 144.940
   Bores for piston: 30.006
   " " 42.414
   " " 42.420 in.
remasured: 66.992
66.985 983 → 987 ave.

just above ring: 66.995 66.982 990, 985, 992 in azimuth
tilts around 66.910
near top: 67.000 987

remasured: 66.977, tapered to larger φ further in
972 970 972
in azimuth
ie up to 0.030
below spec.

right in, can't get mic. out
below spec.
210 Pressure vessel

All within spec.

230.105

67.000

65.043

230.100

65.050

66.988 UNDER
(coarse finish)

145.025

230.110

(Actually 230.000 at bottom is not cleaning up one side?)

2103 Top nut fits OK

2104 Inner nut fits OK

2106 Bottom nut tight OK, fairly snug.
2102  Pressure vessel sleeve
   ID  230.030 bottom end
   "   230.010 top end
   Holes in right positions, all seems OK.

2105  Top blank plug: OD 66.980 OK
   (rather rough finish, blocked)

2107  Bottom blank plug OD 66.980 \{ 144.940 \} OK.

2201  Pressure vessel baseplate - checked previously

2202  Actuator support.
   Bore 100.010
   Register = 251.910
   \text{provisionally OK, checked}

2203  Bottom register φ 252.240 252.095
   marginally over - accept
   Top register 230.050
   \text{within spec}
   \text{(this one should have been specified + 0-100)}
Actual variation 160.105
to 160.030
2204 Stirrup
  M22 Thread in tight
  φ 30.006 too end - OK
  φ 59.985
  Smaller than spec;
  may be able to live with this by
  fitting in sink.

2301 - Plate fitted upside down;
  Thread OK this way, not
  right way up
  - can live with
  - needs thickening

2302 Oil Cylinder
  Registered 160.100 - 0.010
  Below limit
  Upper end bore 130.000
  Lower end bore 130.040
  * Needs a hone

2303 Bottom nut, oil cyl.
  129.985
  Nut fits OK.
  5 mm average
  - will fit bore
2303 Oil cylinder piston
Dia. = 130.080
Should be 129.950/129.980
Actually made for No. 2 piston from No. 2 OK here.

2304 Gas cylinder
OD 160.070
160.055
160.045
160.056
160.075
160.075
top end

Problem to get threads to enter oil cylinder — a lot of time spent filing off damage in thread. Threads OK but eccentric so doesn’t enter register. OK to machine

2303-7 Φ = 40.96 OK

2304-7

Diagram:

41.180
40.980
40.975
41.145
150.015
undersize
9/1/91. Dave Ashdown taking to Sydney:
Two baseplates from No 3 for hacking
Stirrup from no 3 for correcting thread & $60
Bottom plug 4101 for no 2 to correct scalp
Gas piston should go in but actually catches partway; also the clearance at the seal is too small.

* Have to hone the seal seat and further in — done at 47K & received back 27/2/91

2304 Sleeve
159.955, 159.965 upper end very close to lower limit — OK.

3101 Furnace plug — see earlier — OK.

3102 Top piston φ 29.985
Piston extensions 14.985, 990
Bottom " 14.990

4101 Bottom plug — see earlier — OK.

4103 Bottom piston
10: 29.962 — on upper limit — OK
42.370 " " — OK

12: 29.960
54.015 — midway
42.385
30.020

OK
4201    Load cell body
$ 53.980
Thread too tight in 4/03-12
— meds chasing
\[ \alpha = 11.16 \]
Shrinking of Sleeves

Pressure vessel 230.110 OD max) max interference Sleeve 230.010 ID min) 0.100

\[ \frac{0.1 + 0.1}{230} \text{ clearance} = 0.00087 \text{ strain} \]

comp to 79+25 = 104°, about 20° more than for no 1 vessel for which 200° was adequate. Use 220°

Shrinking Entrencher 160.075 max) max intert. Sleeve 159.965 min) 0.110

\[ \frac{0.11 + 0.1}{160} = 0.00131 \text{ strain} \]

\[ \geq 119° + 25 = 144° \]

about 34° more than for no 1 for which 200° was OK, i.e. use 235°C
Re-measured bottom end of cylinder: 230.08

Top of support 2203:
- Side to side: 230.06
- Front to back: 230.11

Spec: 230.072
- 230.060
- 230.000
- Should be 230.000
  230.146

Spec: 230.100
- 230.060

Need to note on drawing to turn after cuts on 2203.
Winding cooling coil.

Used Duralco 132 thermal conductive cement, three coats of 70g — right amount, just a little left.

Used no 8 SABCOistle brush, went fairly well.

Intensify oil cylinder 2302 — ground surface a bit rough. Frank honed it out, grinding marks showed chatter.

To accommodate the top closure of the hydraulic actuator (2212-2) the cylinder support 2203 had to be machined but slightly on ID at bottom — should make ID 174 in future.

Φ 230.050

Top end of cylinder support 2203 is too small to accept pressure vessel Φ 230.110
Thread of thread was running out 0.3 to 0.4 (±0.15) with respect to the bore.

OD register was more a less true to bore (within 0.02) but neither was round to better than ±0.015.
Re-machining done by Frank for intensifier:

The register on oil cylinder 2302 was machined out to \( \phi 160.150 \) in order to allow gas cylinder to enter. 

Thread pin gas cylinder was chased to remove quality to run freely in oil cylinder, and the O.D. was end wired up to the bore. Also the 15° lead was put on (missed in original machining) Pressure Vessel.

Neither top nor bottom plugs fit into pressure vessel, so Frank honed out the \( \phi 67 \) counterbores to:

**TOP:** \( \phi 67.020 \)

**BOTTOM:** \( \phi 67.025 \)

Plugs then go in OK.

It turned out that the vessel bores were just below size on more careful measurement (see fresh notes earlier) & the plugs weren't much below their upper limit, so wouldn't fit.
After the countersinks 867 were corrected, it was now found that the bottom nut would not center. Evidently there is enough closing-down under the shrink-on jacket to tighten up on the nut, which originally was fairly snug. Calculation (see 1988 book) suggests that there could be up to 0.027 mm of closing-down as the interference was a bit more than previously.

So Falk set up the nut 2 1/20 of a little from the thread (which was not out-of-round too) so that the nut now goes in freely. Thread finish is not as good as ideally but should be OK.
Prior box

65.05 followers spread
65.02 50 mm down
First pressurization.
Set both digital meters to zero.
If Heise reading was = 15 MPa
Pumped to Heise = 80 MPa.
Bondon gauge about 70 MPa.
Newport meter reading 1.1, i.e., a factor of about 100 x less.
"signal input" to meter: 100 mV → 100 mV.

Changed config of strain gauge board to S1=E.
Re-tested dig. gauges; Heise zero ok.
Pumped to Heise = 92.1 MPa
Set gain → 92.1 on both DVMs.
Bondon about 85 MPa.

Heise  DVM intensity  DVM vand Bondon
0       0          0       0
92.1    92.1        92.1    85

After standing for 1 h

90.0    91.6        92.1    82

Back to zero to try to get intensity pump working.
0       0.0        0.4      0
0       0.0        0.0     0
14.0    13.4       13.4    8
0       0.0        0.0     0
I
2. M

1 2
2 4
4 8

January census of farm products—

For current year and previous years—

1954 = 1.2 5
1965 = 1.5 3
1970 = 1.3 5
1975 = 1.2 4

1960 = 1.7 9
1965 = 1.6 7
1970 = 1.5 6
1975 = 1.4 5

1955 = 1.1 8
1960 = 1.0 7
1965 = 1.0 6
1970 = 1.0 5
1975 = 1.0 4

Internal walk more fairly bad
<table>
<thead>
<tr>
<th>Bottle pressure</th>
<th>DVM int / ki</th>
<th>DVM jewel</th>
<th>Bounder</th>
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</thead>
<tbody>
<tr>
<td>Heine</td>
<td>13.6</td>
<td>13.2</td>
<td>13.3</td>
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Gas pump:

<table>
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<tr>
<th></th>
<th>DVM 1</th>
<th>DVM 2</th>
<th>DVM 3</th>
<th>DVM 4</th>
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<tr>
<td>104.5</td>
<td>104.1</td>
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Intensifier:

<table>
<thead>
<tr>
<th></th>
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<th>DVM 3</th>
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<tr>
<td>197.2</td>
<td>199.4</td>
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<td>303.6</td>
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<td></td>
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<tr>
<td>494.4</td>
<td>402.2</td>
<td>401.5</td>
<td>387</td>
<td></td>
</tr>
</tbody>
</table>

Some bubbling from intensifier.

Control setting on vent won't go above 487. At 500, still some bubbling from intensifier.

<table>
<thead>
<tr>
<th></th>
<th>DVM 1</th>
<th>DVM 2</th>
<th>DVM 3</th>
<th>DVM 4</th>
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</thead>
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<tr>
<td>491.0</td>
<td>501.0</td>
<td>500.3</td>
<td>494</td>
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<td>493.0</td>
<td>503.5</td>
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</tr>
<tr>
<td>490.0</td>
<td>500.4</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Pressure dropping at mod rate - must be leak somewhere in excess of intensifier, maybe gage.

Refumped to 500,osed intensifier out valve. Leak is in intensifier circuit, stil; could be Heine.

Dropped to 391 react to 400.7, 480.1, cal next OK.
Diam: 65.055 below seal
65.025 50 mm down
Do stretch = 0.005 at 500 MPa
Dropped pressure
Heise  DVM intensif  DVM vessel  Bounder

About -3 at first (Tuffed?)
 came back to about

| Measured bore — see left. |
| Put Disagrin O-ring in intensifier |
| Reset zeroes: |
| 0.0 | 0.0 | 0.0 | 0.0 |

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>13.7</td>
</tr>
<tr>
<td>102.0</td>
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<tr>
<td>101.2</td>
</tr>
<tr>
<td>203.0</td>
</tr>
<tr>
<td>201.2</td>
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<tr>
<td>304.2</td>
</tr>
<tr>
<td>302.0</td>
</tr>
<tr>
<td>404.0</td>
</tr>
<tr>
<td>401.3</td>
</tr>
<tr>
<td>506</td>
</tr>
<tr>
<td>498</td>
</tr>
<tr>
<td>402.8</td>
</tr>
<tr>
<td>398.5</td>
</tr>
<tr>
<td>308.8</td>
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<tr>
<td>308.2</td>
</tr>
<tr>
<td>Heise</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>210.5</td>
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<tr>
<td>210.5</td>
</tr>
<tr>
<td>110.8</td>
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<tr>
<td>111.3</td>
</tr>
<tr>
<td>~ -1.5</td>
</tr>
<tr>
<td>~ -2</td>
</tr>
<tr>
<td>~ -1</td>
</tr>
</tbody>
</table>

17/5/91

Removed Heise gauge & put in blank Pressure gauges take a while to settle down. After a few minutes:

\[
\begin{align*}
-1.4 & \quad 0.5 & \quad 0 \\
-1.3 & \quad 0.5 & \quad 0 \\
-1.1 & \quad 0.5 & \quad 0 \\
-0.9 & \quad 0.5 & \quad 0 \\
\end{align*}
\]

Opened bottle

| 11.3 | 2.8 | 0(t) |

Pumped on gas pump ~

| 94.3 | 95.6 | 90(t) |

Pumped on intensifier to 520

| 501.3 | 500.0 | 500 |

dropping too fast, must be small leak At 550 leak = pumping rate
DVM int/ext

Back to room pressure
Leak at 4-way connection to intensity p gauge.
Tightened.

-0.4 \( \Delta = 0.8 + 0.4 \)

Bottle pressure

11.4
12.8

Gas pump, then intensifier
Not too bad at 500
Intensifier leak at 600

+0.1

616.5
618.0

Sprang a leak at \( \sim 650 \). Leak at entry to 4-way from Intensifier Out valve.
Tightened.

+0.3

Bottle: 11.7
11.8

Intensifier leak \( \sim 550 \)
Larger leak at \( \sim 670 \). Back of gas release valve.

Back 6
0.7
0.3

Left switch on over night. Next morning gave:

\(-0.1 + 0.4\)
Setpoint on Newport Meter 992015
As supplied, max setpoint was about 486.0 with standard config SR1 = B F I M on pin#255
(p39 of book).
Changed to SR5 = C G J K of IV range.
Now max setpoint ~ 240, ie half before.

Tried 0/2V, SR6 = C F J M
Now can get up to 525

Talked to Mike Farkas, AMS — he can't see any reason & suspects a fault. Can either send back to them (not really time) or contact Newport in Minneapolis.

20 to 22/5/91

Machine moved for photography.
Plot of measurements 4 pages back gives 454 Heise = 450 DVM initial so the meters are reset opposite to bring these members into agreement.

Pressure test to 725 MPa.
Continue Pressure Testing

Reset zeroes on meters

DVM internal  DVM vessel
-2000.0  -200.0  zeroing up still?

Bottle  11.3  11.4
Gas booster  91  91

internal 450.2  450.0
reset to 454.2  reset to 454.0

ie calibration should now be OK
slow leak at 625, max reached due to air pressure
leaked back to 606 in couple minutes or so
675 — intensifier leak started.
680 sprang a leak.
Appears to be a gross leak at entry to vessel
or smaller to intensifier.

Zeros:  -000.1  +000.4
   -000.1  +000.5

Bottle  11.0  11.6
Gas booster  ~97  ~97

Intensifier leak started again ~625
Went to 725, sprang a leak — vessel p. gauge.

New zeros:  000.0  004.9
   000.7
Left overnight

Next morning reset to 000.0 000.4
substantial zero shift
000.7 000.0 after overnight running
Main reservation – pressure vessel pressure gauge zero moves around much more than the intensifier gauge reading – seems to be more temperature sensitive or something.
Pressure here after 725 MPa:

Just below O-ring 65.06 - icer 0.010
30 mm down 65.045 - icer 0.025

Put 700 MPa rupture disk in & retested

20: DVM inter 0.1  DVM med 0.4

200: 0.2  0.04  0.05

Base 10.5  11.7

Up to 600: 600.0  600.9

Back 0.2

Only very small leak at intensifier, intermittent.

Holding pretty well after thermal finished. Dropped 0.7 MPa in 1 minute on very small volume.

So 700 MPa rupture disk holding OK.

Pressure system checked out.

Let intensifier right back - oil just came to top of sightglass.
Two reservations about this load cell:
1) finish in feed-through seatings
2) screw holes for screws holding centre plate not tagged quite vertically — had to use loose screws fits to assemble OK.
Internal Load Cell

```
- green
- red
- grey
- green
- grey
- blue
- excitation
```

output

Initially set so 0.18 gapless gauges slide freely between all plates, with metal film between.

Adjusted capacitances on the pins on plates before connecting up. All equal to 48.4 ± 0.1 pF.
Allen's "rear view" diagram of plug, ie look at the wiring side (or upwards from inside of rear view box).

Key:
- Bridge 0/1

On D25 plug:
- Input 2
- Screen 3
- Output to meter
looking into the preamplifier box.
(again looking down)
Assembled Emerson pumps etc for operating hydraulic actuator.

The actuator itself needs nearly 50 psi oil pressure, equal to 1.18 kN of frictional force to operate, equal to 296 N or 30 kgf per seal.

— seems quite a lot & raises question of alignment, although this should be OK.

Assembly of stirrup etc

Failed to assemble — the nut on the 3/8" tubing rod connecting the bottom pistons of ø20, failed to pass through the "M22" thread on the stirrup. Measurement showed the thread to be actually M21.6 x 2.5, with minor diameter = 19.5.

Actually on checking standard sizes, an M22 thread should have a minor diameter of 19.3, so this should not have passed the ø20 nut on the other two machines. How did they happen to assemble OK?
Since the thread in the stirrup has approx. the right minor diameter (actually a little over) but a shallower depth of thread than it should, we cannot risk to open up the minor diameter.

Therefore, we sleeve back the preamplifiers housing to reduce the diameter of the retaining nut to φ19.

Then found that the stirrup was not screwing right up to shoulder on the piston - the thread had not been cut to the end. So had to relieve the thread for 5 mm, leaving about 15 mm of thread.

With \( \tau = 20 \) 
area of thread = \( \pi \cdot 20 \cdot 15 \) mm
so strength with 800 MPa yield
\[
\frac{800 \cdot \pi \cdot 20 \cdot 15}{2} = 377,000 \text{ N} \\
= 377 \text{ kN}
\]
against design max. of 100 kN.
100 psi = 2.37 kN
Internal load cell test:
At atmospheric pressure, with 5V stiff
excitation from internal source, get
reading output on Fluke meter, get
tzero reading (very sensitive to body
movement) of ~ 26 mV.

Cycled load:

<table>
<thead>
<tr>
<th>psi</th>
<th>kN</th>
<th>25.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>2.37</td>
<td>25.3</td>
</tr>
<tr>
<td>150</td>
<td>3.6</td>
<td>24.8</td>
</tr>
<tr>
<td>200</td>
<td>4.7</td>
<td>24.3</td>
</tr>
<tr>
<td>250</td>
<td>5.9</td>
<td>23.6</td>
</tr>
<tr>
<td>300</td>
<td>7.1</td>
<td>23.1</td>
</tr>
<tr>
<td>350</td>
<td>8.3</td>
<td>22.6</td>
</tr>
<tr>
<td>400</td>
<td>9.5</td>
<td>22.0</td>
</tr>
<tr>
<td>450</td>
<td>10.7</td>
<td>21.5</td>
</tr>
</tbody>
</table>

gives reasonably linear plot. Main
problem is initial offset.

Range of zero adjust is 75 mV → 46 mV
1σ approx ± 15 mV

Due to non-diff because meter moved,
indicating 6 mV with no excitation
Meter zero leads/horiz ~ 1.0 mV
Load cell balance seems to have changed. Measured on pins in HP space:

- Red - blue: 150
- Red - green: 188
- Red - grey: 262
- Blue - green: 239
- Blue - grey: 257
- Green - grey: 240

Disconnected all plates:
- Red - green: 47.5
- Red - grey: 47.6
- Blue - grey: 46.6
- Blue - green: 46.5

On feed through, plates still disconnected:
- Blue - grey: 128.6
- Blue - green: 172.8
- Blue - red: 106.7
- Red - grey: 104.5
- Red - green: 126.3
- Green - grey: 185.0
\[
\frac{168.7}{146.7} = 1.150 \quad \frac{196.4}{162.7} = 1.207
\]

Diagram:
- Green
- Red
- Grey
- Blue
- Total ridge as seen from leads
- 147.6
Earth - Blue  183.7
- Red         176.9
- Green       173.9
- Grey        178.8

Reconnected all wires, measured on Keithley's
Red - Blue   146.8  147.6  147.6
- green      163.6  168.7
- grey       145.6  146.8  146.7
Blue - green 198.1  197.3  182.4
- grey
Green - grey  162.7

Reassembled in bottom plug & set up on
base at back of machine. Put 5kHz 5V excitation
on #1 measured with Fluke (zero = 1 mV)
Reading = 14.0 mV, depending on // still
on any position without power on.
With power : 982 mV
         932 mV with capacitor at one end
         1118 mV at other end

Took out again.
Note on Transformer

The blue/red wire on 56/7,8 Ω = 1000Ω goes to Intron, carrying the signal input to Intron. 12/3,4 have to be connected to pins 14,15 on D25 plug.

Connect if reading is ridiculous (means common is going to ground).
(The pin 3 should go to ground if there shouldn't be a problem)

Note on Newport control
S3 jumper on main circuit board placed on in order to get full span.
Disconnected plates again
Resistances to earth
Red   0.757 MR
Blue  2.003 MR
grey  0.685 MR
green 0.198 MR

Disconnected stem wiring (at pres.
side of feed thru's)
Resistances to earth on feed thru's:
Red   0.777 MR
Blue  2.056 MR
Grey  0.667 MR
Green 0.215 MR

Wires on stem give OL
Insulate OA

Conclusion: Forgot to specify Diaphragm O-rings
instead of black ordinary.

Changed all O-rings & reassembled.
Resistance to earth at each feed thru's
now open circuit.
Readjusted plates before wiring:
blue - black 49.8
blue - green 50.1
red - green 46.8
red - grey 46.5

Connected up, with meter on output. Even with excitation disconnected, there is an output of 0.54 V (varies from 390 mV to 16.8 V depending on trimming capacitor).
Lifted off pre-amp \( \rightarrow 180 \text{ mV} \)
\( \approx 32 \text{ mV without power on preamp} \)

Checked load cell again - no plates shorted to earth or each other. Capacitances

<table>
<thead>
<tr>
<th>Red</th>
<th>Blue</th>
<th>Green</th>
<th>Grey</th>
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<tbody>
<tr>
<td></td>
<td>146.6</td>
<td>134.2</td>
<td>136.5</td>
</tr>
<tr>
<td>blue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- green</td>
<td></td>
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<td></td>
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<td>- grey</td>
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<tr>
<td>grey</td>
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</table>
Removed the lead on D25 connected & measured voltage directly on pin — 0.7 V, so problem is not pickup by the lead.

Put lead back on — 0.79 V

Twisted inexcitation (black/white & shield) together — 0.937 V (same when clip on earth) earthed bottom plug — 255 mV when take preamp off plug 1LC (same when isolated, as earthed)

— 54 mV when unplugging lead into preamp. (80 mV power off)

Installed in machine, w/R leads to 1LC

Resistances OK.

Capacitors:

- at pin 10 MΩ 100 MΩ 200 MΩ 300 500 MΩ
- red-blue 146.4 149.7 163.0 167.4 170.1 172.9
- green 133.4 136.9 152.7 157.6 160.3 163.7
- grey 136.2 139.8 155.2 160.6 163.4 166.8
- blue-green 134.9 138.6 154.5 160.0 162.9 166.3
- grey 132.4 135.8 151.1 156.2 158.6 162.0
- green-grey 126.8 129.1 140.1 143.5 145.6 147.8

Piston friction psi

- 250
- 150
- 100
- 60
- 40

- 150
- 700
- 500
- 250
- 550
- 500

- 150
- 150
- 550
- 550
- 550
Looking down on TC

- Red dot
- PH/ RH
- Lemo connector
- Triangle TC
- TC 2
The OK at 500 MPa in cap. 9 resist, & no leaks.

Test on 427 furnace plug with dummy pistons.
 Took to 408 MPa, no bubbles (ran out of nitrofumate).  

Tested out furnace circuits with 255.2 resistance in turn on the plane winding (L → R of thermistors & fuses are TOP, CENTRE, and BOTTOM).  

May need to check Thermocouple connector for 1, 9, 2 (see oppo.)
Jutson attach screws need to be 6½" max = 165 [160 would do].
Depth of thread in Jutson was ~3¼", ie ~ 0.19

Installation: Some confusion in morning because main crate arrived in a covered truck, and on 9 it was not clear how to get it out (d how they got it in). However, around 10am the moving man Tom arrived with truck & equip & soon got it out after de-rattling. Got it onto corner wheels, down lift, along corridor, up another lift & into lab by lunchtime. In afternoon, put in actuator — some problem with bolts too long, & had to shorten them (see above) but finally in place.

Uprighted the machine using an A-frame & two block & tackle lifting on the lower eyebolts (limited headroom). When approaching neutral position, put studying blocks under the feet legs & with ~20mm gap pushed machine
by hand through mental. Then with jacks let the machine down in small stages on to these legs after "walking" it into the approximate final position. All this time, the floor was covered with plywood panels from the crate, which was taken out near the end. The A-frame was on wheels so it followed the machine. After the machine was in place, an extra liner tile was put under the left back leg. The guide post of the Instron actuator was very near the floor, clearance ~ 3-4 mm. Also attached platform, etc.

12/6/91

Mainly finer details, tightening actuator bolts etc. Pumped up to 400 psi in afternoon after argon connected & air. Water also connected today.
After assembly, contact point at bottom position is -2.5 mm.

No pressure friction ~ 0.1 kN upwards
~ 0.06 down

Contact at top position is -30.0 mm.

When turned on, noisy at ~+3 kN. & this went to near zero when actuator turned on, still noisy.

Tried to calibrate without much success.
Reading went up with load but wrong polarity & not enough – would not calibrate.

Inspected plug from Instron – terminal 14 (output +) seemed to be not in place properly in plug – also opposite sign to that given by Instron.
Pushed terminal into plug better. Now reading steady but about 67 kN.
Put in furnace
- no #4 5 & 6 thermocouples backwards so changed over at junction inside cabinet, now red - black, black - red.

Assembled:

(Thermocouple would not go through 85 Al₂O₃ piston - hole off centre > clearance)

Set current limits on bottom & centre but when tried to set top, at first no response, then blew fuse.

Took out furnace & checked resistances - see next page. Became clear that furnace connections were 90° out of phase, explaining the short and the reversed thermocouple polarities.

When moved pin, furnace OK & had to move TC polarities back.
Actual furnace connection (on furnace plug)

- Bottom TC: 0.462
- Top TC: 0.87
- Center Power: 0.97
- Top Power: 0.53

Furnace connection:
- Key here
- Moiré pin
On going up, guessing a leak at ~950°C on spec. TC — had forgotten to attach leak tubes 1 & 2.

Leak was a junction of CSZ & Al₂O₃ pistons at top, due to different changes.
Some items for future

Blank top piston
Socket & wires for testing LLC
25pin D socket & wires
Dimension protective plug on LLC better & provide extra cap.

11C attach stem to be 10 O.D.
Provide some 10P AlO3 endpieces
Extension parts
Extra bottom piston
Voltage output from LEC:
Measured across pins 14, 15 with 5V excitation from Instron
Load on LEC 0 KN
2.6 \\
5.0 \\
10.0
78 mV output (zero)
175
375
803
readings steady
ie 1450 mV/V full scale \( \frac{(803-78) \times 10}{5} \)

Tuned gain 1 turn anticlockwise on preamp
Now zero = 72 mV
5 KN = 245 mV \(\rightarrow\) 692 mV/V
Tuned gain another 1 turn anticlockwise (turn total 2)
340 = 69 mV
A = 123 mV
5 KN = 187 mV \(\rightarrow\) 472 mV/V
Put 220 \(\Omega\) resistor into pin 4, 5 circuit.
zero = 64 mV \(\text{(OK?)}\)
5 KN = 187 mV

Instron now identifies it as an Instron transducer
but still will not scale.

By this stage, had Norton switch on back of
frame frame interface box from X20 \(\rightarrow\) X1 in the
extensometer channel in use.
Instrum circuits:
PIN connections
LOAD EXTENS

<table>
<thead>
<tr>
<th>PIN</th>
<th>LOAD</th>
<th>EXTENS</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>K2O red</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>R1, R2, R3, R4</td>
</tr>
<tr>
<td>12</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

R4 = R5
K1 || K2
R4 = R5

in box behind connector

15 pin conductor
25 pin connector
Intron female connector
360Ω for 35 or 700mV/V from Intron

Our part

5V relay

Lift the wires going to 7, 10 to power relay with 5V
In morning discovered that 12C off air & the 65 connecting piece from 12C to bottom nut was broken. Turned out that the range of movement of the upper bottom piston, carrying the 12C, was about 2mm less than the lower, seemingly due to contacting the 45° surface too soon although measurements were not very clear in confirming this.

So a 2mm space is needed above the bottom piston O-ring piece.

After this, the external wiring on the 12C was removed (the wire was open circuit) & a temporary flexible wiring put on (see next page). However, after this the zero of the 12C was reading about 400 units. There were no obvious shorts & the capacitance bridge did not seem grossly out of balance. At about the stage, 22k was added things to the 45, 7, 10 pin wires on the 35D connector but these are all in a separate, transducer recognition circuit in the Instrument & should not affect it.
1973/81

```
103
/reels/
101 105
/grey/
101
105
green
blue
```

84
Reconnection of MC:
- red → black
- green → white
- grey → yellow without knot
- blue → yellow with knot

On end of cable:
- red - blue: 8.45 / 83.0
- grey: 101.1 / 199.7
- green: 103.8 / 103.0
- blue - grey: 105.6 / 105.0
- green: 105.6 / 104.9
- grey - green: 101.2 / 101.2

Unloaded:
- zero = 425 mV
- 1 kN = 459
- 3 kN = 519
- 5 kN = 588

- zero = 426
- 5 kN = 599
- 1 kN = 462
- 3 kN = 524
Put transformer in output line
Zero now 379 mV
On Inner side 5 kN 432 \( \Delta = 53 \text{ mV} \)
On Outer side 585 \( \Delta = 99 \text{ mV} \)

Reduced gain by about 6 more bars.

New meter gives 227 mV at zero
5 kN 259 mV 42 mV on 5 kN

The Instaion can shift zero; did that.

Told it 100 kN load cell but that load = 20 kN
When in fact it was 5 kN
Went to -10 kN — reading - 41 kN, -7½, 32½
Your supply common should only be connected to internal shields.
Outer shield should be separated.
Take a meter, resistance open circuit from pin 3 to common supply point.
Take lid of printing, look between at board marked "OV in between 12V -12V"
shell on plug
Could try joining them.
Transformer provides total isolation.
If don't have, signal out ground point is connected to one side of induction — may get away with it.

Prefer ultimately to see it in line. Any transformer provided input impedance 4 3000Ohm
Thinks induction reasonably high impedance

English one — definitely need a transformer, he thinks because of simple shielding.
If only 600/600V, put 2k resistor in series.
Still worried with the zero offset. So took out 12C, disconnected leads to plates & checked capacitances:

- red - green 48.8
- red - grey 48.5
- blue - green 50.1 (readjusted to 47.4)
- blue - grey 48.7 47.1

After reconnecting:
- red - blue 85.8 87.9
- green 103.2 105.6
- grey 100.4 103.3
- blue - green 106.4 107.6
- grey 106.9 109.1
- green - grey 100.8 102.2

Excited, zero = 376 mV, min. at 90° on diff. Tuner off, " 200 mV.
CRO shows min. to be 60 cycle.

Made a new plug for Intron connection, connections as before, zero again 376 mV, down to 340 mV, diff. cap at 90°; CRO shows 5 kHz.
United Transformer New York NY 0-19 4 mag. shield 0-17

182 v. 394 2.5 kΩ → to preamp
506 v. 788 1 kΩ → to Intron

Calibrating kit:
Spring
Two filler pieces for spring
Threaded rods
Bottom piston with ball seat
Dummy filler piece
Three 15Ω balls
When switched on power to preamp, $\text{g}_\text{no} = 530 \text{ mV}$ before Inshot connected.

Protrusions $\sim 2.8$ to $0.9$ after about a minute.

After starting Inshot, $\text{g}_\text{no} = \frac{333}{576} \text{ mV}$

According to drawings, dimension $X$ should be 61. In actual measurement, it was 63.4 or 63.5. The $\phi_{30}$ part of the piston seemed to be about 64.5 instead of 65. Thus around 0.5 of the excess may have been on the piston and nearly 2 in the body of the plug. Thus we need a spacer of 2.5, with OD 42.3 max and ID 30.1 min to prevent the fracture of the connecting rod that has already occurred. Another measurement showed a gap of $\phi_{2.2}$, so 2.5 should be OK.
19-11-91  Visit to Lah - Minniegroh

Around 20 runs altogether
Done about 9 runs on HT furnace at 1300°C (2@900°C)
Power fairly consistent but temp profile varies run to run.

SS inner sleeves melted at 1200°C runs in HT furnace
MS " 1300°C in HT furnace
ZrO₂ OK - but some reaction gets at hot end
Problem with some water - melting on furnace can rather than in vessel.

Had short circuits from brass connectors to met a couple times. Not recently - i.e. plug to furnace.
Once had to clean a connector in T/C circuit once.
Using a type K, molen sheathed T/C in 1300°C - chip in quickly

T/C - Calib good to 5 kN after 10 runs
5-50 kN external & internal agree
Promising - zero goes to -3 kN then back to -2½ kN.
No obvious pressure effect
Stiffness 12 mm / kN on Instron LVDT 7.7 at collar
Friction 13-15KN at 380 MPa.
Coulpe times TC shorted out but came good again (did so on run on 20/11/91)

Major problem is with Al2O3 pistons - grabbing on TC.
Not clear which is most important: Rate-limiting
- hot pressing of the material
- plastic flood into the hole
- decrepitation into the hole.
Possible other materials: Thoriated tungsten
Thorin
silicon nitride
Al2O3 coated SiC
CBX (stable?)
Also still a problem with buckling. (Related to cool faults? ?)

Would like to have an internal displacement gauge. Linear resistor type?

Alternative to movable TC in piston:
- captive TC & make joins?
- rely on furnace TC?
Problem with latter lies in non-repeatability of T profile from run to run - seems mainly ??
Concern the top winding - something to do with the efficiency of the ABV3 paper seal? This packs down quite hard at bottom end.

Enormous swelling of top piston O30 O-ring - some sort of "Viton". Also top jacket rings (using two small section rings) swell considerably & remain that way sitting overnight at bottle pressure - the latter are ordinary O-rings.

Disassembling jacket in aqua regia, timing as this is still some metal core specimen - takes 1/2 hr or so.

Instron actuator is leaking oil down the bell screw somewhere - had Instron people in.

When about to do run, found that connector to bottom winding feed line had overheated - seemed not to have been done up properly (potentially drooping full tightening - should machine back first couple threads on rod) & was arcing. Cooked plastic insulator & burnt into feed line...

Put in a new brass connector & new insulator & washer under it & turned around the plastic line...
of the lead hole in panel. Also exchanged with connectors next door to avoid putting large power load on feed-through.

Furnace (HT) top T/C reads ~ 1150°C and other two ~ 1000°C for 1300°C specimen.
Control on bottom T/C (top T/C is too variable).

When took out furnace, slight rust on can; that in feed wiped off easily.

After giving connection, furnace at BT/C = 800°C still took 12½ amps but now 12V instead of 24V - ie bad connection was dissipating ~ 150W in previous runs. Now furnace control was oscillating until re-tuned. Tuning had not been done previously after changing from LT to HT furnace.

Controlling on B Thermocouple HT furnace at 1220°C 1235°C 278 MPa (10th run)
Top 8.2 amp 16V 4/992°C
Centre 5.0 23 5/885
Bottom 14 29 6/899

0.53 W/K (earlier was ~ 0.46 W/K) Bit too peaking at top of profile.
Using a K/Inconel TC & only dipping into hot zone.

Profile too peaked above (~50°C; Greg likes to run with ~10-20°C peak at top)

In first run on HT furnace, bottom current was 12 amps, now up to 14 amps on 10\textsuperscript{2} run; still 13 amps on 5\textsuperscript{2} run

\begin{align*}
\text{new} & 14.17 \\
\text{went up to} & 15 \text{ amp early in the run while at 1300°C. But set-point still similar}
\end{align*}

When we had the furnace out, there seemed to be a join in the core at about 8 mm above the bottom end of the inner sleeve—unbut there shouldn’t be such a join according to the drawing. So there a crack here?

Has handling the furnace shaken the zinc oxide loose insulation around? It was taped up & down many times. There is also a break in the Kienor bottom piece, at the lip below the core.

Final furnace adjustment 0.55 W/K before deform.

At end of run, 0.59 W/K. Jacket O-rings more swollen than previously but still not affected by heat except to swell.
at 1300°C

New piston used in the rear shortened from 50.14 → 49.62, \( \phi \) 14.99 → 14.65 last end

Spacer (fresh) \( \phi \) 10, originally \( l = 12.22 \) mm, now 12.23
(Made from a distributor)

ie no change resolved.

Previously used piston didn’t change much. + piston shortening specimen shortening comes to observed shortening, so shortening in new piston must have occurred under hydrostatic pressure initially during deformation, at ~22 MPa – still could be densification with time.

Decrease in piston drain > hole fill-in

Took out furnace:

~27 / 26

\( \leftarrow \)

B

\( \rightarrow \)

~15 / 3

\( \leftarrow \)

should be 28 ~26

\( \rightarrow \)

T

Inserted 50 mm length of iron lined in bottom end to cover the gap (could’ve been an intentional join or not), but it seems to be exactly at the bottom end of the bottom winding)
22/11/90

Grz worried about 30 mV offset in ILC reading, so bottom plug taken out (can be 80 OK without taking out furnace).

Bit of dust but seemed OK.

Discussed new lead stem, possible change to half-wedge wiring so as to incorporate a dipole transducer such as linear

F. jhi^Ju/ /»r^c|^c^í^T  ;  ¿/»y

Also several problems with pickup — next to ILC, & on ILC piston: comp. piston seemed to be OK. Everything very dry.

Reassembled with some molykote (sprayed)

(Yes, but it was too thick & was difficult to remove).

Found that a resistor had come undone (part of alternator) so re-soldered — this more or less restored the zero but it was now

around +1 kN instead of -2 kN.

Discussed problems of misalignment—
question of squareness & rigidity of the

small screws at the top. Should the
top plug be re-designed?

drawn
New ILC lead

Looking from preamp to ILC
new one:

- Green
- Red
- Grey
- Blue

old one (which makes OK to connectors in ILC):

- Red
- Blue
- Grey
- Green

Therefore had to wire as follows:

<table>
<thead>
<tr>
<th>Preamp</th>
<th>1 Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal</td>
<td>3 Grey</td>
</tr>
<tr>
<td>Blue</td>
<td>5 blue</td>
</tr>
<tr>
<td>Grey</td>
<td>7 red</td>
</tr>
<tr>
<td>Excitation</td>
<td>1</td>
</tr>
<tr>
<td>Green</td>
<td>red</td>
</tr>
<tr>
<td></td>
<td>blue</td>
</tr>
<tr>
<td></td>
<td>grey</td>
</tr>
<tr>
<td></td>
<td>green</td>
</tr>
</tbody>
</table>

Had to extend red wire (not) because cut off too much by mistake. Soldered up. Seems OK.
Piston now would not screw on to load cell.

Checked piston:

23.72
24.15

Across at approx azimuth of flat

24.15
23.72

20.43
0.215

Off centre

So this hole is off centre at this end by 0.215; not bad at bottom end, so presumably drilled from that end.
Discussion with DK:

1. EDM 12C piston to reassemble lower piston assembly
   2. Possibly P85-burnished the 12C piston bearing surface.
   3. Dye for internal HP oil piston
      Candidate oil cylinder to ease oil piston by .002".
      How to put fresh oil into bubbles

Dave to explore internal displacement gauge
(Same M has tried Trans-Thed LVDT's)
OK in pressure vessel
Trans-Tek
P B D Box 338
Rt 83, Ellington Conn 06029
Not in catalogue

Question of face of small nut retaining the top piston being square enough.

Left & Al2O3 pistons + 2 PSZ pistons.
Dave to send order for 6 pistons + 2 PSZ pistons
+ new furnace.
Next April:
Dave keen to have me visit
Possibility of a seminar to pay a little.
Leave Spring here & me collect it in April.
Furnace 006

Returned for refurbishing this week, after runs at 400 & 500 MPa 1300°C (total 23 runs).
Insulation, with SAI1 inner insulation, in good condition.
Presumably Bendigo core.

Alloy furnace core cracked at bottom of bottom winding & an easy along it & the piece in between had an open longitudinal split (did this open up in 500 MPa run?)
PSZ upper core also had a longitudinal crack.

Asked Frank to make grooves shallower (~0.6mm) in new core, as well as introducing 45° chamfer at ends of grooving & larger radii at bottom of grooves (the core in above case did not get this).

Top winding still bright & wires more brittle.
New M40 part needed at bottom & top most.

Crack in middle of bottom winding looks older & at bottom looks fresh. Longitudinal crack looks old & there are a few more small ones.
28/7/92

Furnace 006 - refurbished

<table>
<thead>
<tr>
<th>Resistance</th>
<th>Top winding</th>
<th>Centre</th>
<th>Bottom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.06 (7)</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>- 0.03</td>
<td>- 0.3</td>
<td>- 0.3</td>
</tr>
<tr>
<td></td>
<td>- 0.8</td>
<td>- 0.8</td>
<td>- 0.8</td>
</tr>
</tbody>
</table>

New Macor at top (no 11) & bottom (no. 21).
New Alumina core - Duralic from Green.
New upper core (PS2).
New wire from Degussa.
Cleaned silver contacts (by dipping in Goldard silver dip, rinse).
Zincaria paper against core; same SAE insulation as before; alumina paper elsewhere.
Furnace 007

- returned, never useful from first assembly.

Before disassembly, could see:
- small longitudinal crack in PSZ at hot end
- large circum crack low in Al₂O₃ - wide open
- " " " high in Al₂O₃ - fully open
- some longer cracks low in Al₂O₃
- another circum crack somewhere in middle of Al₂O₃
- a number of meandering cracks high in Al₂O₃

Opening up:
- First segment
  - Some discoloration at bottom end of outside Al₂O₃ paper
  - Lot of color on bottom face ≈ ½ way up dia. of lowest PSZ piece
  - Top of top, white, at top
  - Middle white

ASH piece OK.
- SATJ discolored on outside:
  - Grey

Segments similar; slight asymmetry in temp. contours.

Core:
- Cracks - bottom of bottom winding both cracks
  - Top of top winding split apart
  - Bottom longest crack runs up to bottom of center winding
Longitudinal crack in PSZ piece as in heat furnace.

Crack at bottom of bottom winding fairly disturbed—open during running.

Crack at top of top winding clean but at higher than C contour.

Again longitudinal streaks in the alumina—higher density, but light through.

At top winding, core ID = 20.85, 20.75 outground
cold bottom = 21.00 .01
At top joint = 21.00 .01
just above top crack: 20.9, 20.8

Join in PSZ & Al₂O₃ could be further up?

Nov. 8, 1992

Replaced by Frank with new Duramic core, all other parts the same—using alumina paper. Checked connections (leads 0.3):

<table>
<thead>
<tr>
<th></th>
<th>Winding</th>
<th>T/P/C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top</td>
<td>0.7</td>
<td>0.9</td>
</tr>
<tr>
<td>Cura</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Bottom</td>
<td>0.9</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Sent back for checking lead connections on core—were loose.
Refurbish no 6: 26/10/92
Cut off bottom of bottom windings & added lower end with overlap.
Resistance (0.4 ± 0.0) TF 0.7 TTC 0.9
M 1.2 M 1.1
B 0.8 B 1.3
Winding groove still 0.6 deep.
Lead connections now loose.

13/2/92
No 6: Back for refurbishing. Bank's description on telephone:
- added piece appears pushed down a bit.
- some "corrosion", brownish, on winding - contain ?
- alumina paper hard
- one section of SAH at top cracked through some other partial cracking
- core added piece has lip cracked off (not Bendigo material - is yellowish)
Refurbished with new lower core extension machined from Bendigo stock, otherwise all parts as before
Resistances (0.4 ± 0.0) TF 0.7 TTC 0.8
M 1.2 M 1.1 M 1.0
B 0.6 B 1.2
- except bottom winding
Furnace 002
26/2/93
Early LT furnace with SS upper core. SS core was very loose, insulation missing — they must have removed this. confirmed by ken

Bottom / top segments all cracked.
Some connecta screws loose & some rotated — must have been fielded with.
Bottom T/C damaged near top — needs to be replaced or welded.
Connectors very black — been very hot?
Insulation OK — rather grey next to windings

Furnace 006
13/2/93
Some gunk on winding; SA11 cracked through

[Diagram]

^cracked off here on bottom section of articulated core. Also some large cracks in the thin broken off part (not Bendigo material). Put in a new part & sent back.
Furnace 007

This had been re-assembled at Minneapolis using a tougher insulation paper. Also, they had put cement over the windings. Fair bit of carbon around.

Insulation generally OK but some crazing of S&H1 at hottest place. Connectors a bit loose.

Bottom of core, just below bottom winding, very nearly cracked.

There was also one short length, crack running back from this crack face.

1/4/93

Refurbished with same insulation & parts but new Corex core. Old PSZ upper core.

Resistance: Windings T1C

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6</td>
<td>0.8</td>
</tr>
<tr>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>0.6</td>
<td>1.2</td>
</tr>
</tbody>
</table>

18/4/93

Cracked first run before 1180°C. Ramped 20°C/min, 100 MPa, settings 40/30/100 (usual).
Purmer 002 (LT) 1/4/93
(retumed 26-2-93)
New core core
New O3Z upper core
Same parts otherwise (bottom macor cracked)
Resistances: Winding T/C
0.7 0.7
1.2 0.8
0.7 0.9

1/4/93
Initially bottom winding attach screw was loose -
They had to tighten it. Looked OK when I checked it.
Core looks OK. Also bottom T/C charted.
Bottom T/C giving low readings - shorting near top.
On heating, not near top I couldn't get above 800°C
Couldn't control on bottom
8.8 50°
6.1 70°
142 A 100°

[Diagram with arrow labeled 'crack']

? Which is this? 007?
Test ran over page.
Furnace 006

Its efficiency improved as temp went up, from 0.52 down to 0.45 W/K.

Fuel calib: 18 runs up to 1250°C - 1100°C
On 19th run, calib 3 pressures. Then power failure, cooled, switched on, full power back (without ramping up). So could have been thermal shock.

Did a deformation run after but furnace not stable
10° at across specimen at -600°C 15/4/93
cooler downward no 4: 552°C controller
5: 398°C

Currents: 4 8amp 10V: 80.6 not connected.
5 4 11 44 of ~700°C
6 16 22 358 487 0.7 W/K.

Getting worse at 700°C. Pressure 130 MPa.
Dropped pressure to 100 MPa. Furnace now more responsive

Typefile  Still ~ 0.7 W/K.
Stopped pressure further to 90 MPa, immediately more responsive but gradient still bad.
With only bottom winding, peaks below specimen at ~ 1050°C → 1080°C still climbing.
Controlling at 800°C on water: 94 MPa.
Now brought in water at 82°C, windings at half previous rate, drops lower temp rapidly (still controlling on 4) — temp distib now flatter but rather unstable.
Temp up to ~1250°C but very unstable — must be a gap above hot zone; or PID settings are off for control of bottom winding by top T/C
— 1250°C profile, settings 32.5/20/100

Based on 1175

7 = 0.45 W/K.

Slight me in 3.74 power gave profile.

Could this be due to unstable PID setting? Probably not — should just give an oscillation.

Took out next morning — cracks in core about ¼ way up bottom winding (38 from bottom end of core)
Recent histories:

002

After the run described on previous page the furnace was returned to Canberra (~27/4/93). It was fitted with a new Coors core with a longer bottom winding & shorter centre winding & a new fully ASHT insulation (the previous composite insulation had shrunk somewhat & the bottom TC shorted to the winding). Sent to Minneapolis 30/4/93.

It was reported to have cracked "in the usual way" immediately on running.

(Date 15/6/93)

Twisting the wires together??

Altogether, these observations fit with extreme thermal shock as described in page 20.
After the history reported 3 pages back, it is not clear whether the furnace had more usage or not.

It was returned to Canberra recently (v. 25/6/93).

A postmortem showed:

1) The core was extensively cracked up & had expanded in diameter nearly 1 mm about one-third to one-half the way up the bottom winding section, opposite the place where the iron sleeve had begun melting.

2) The lands were distorted in this region, indicating extreme softening of the alumina.

3) There was one spot on the bottom winding, about ¾ the way up, where there had been melting, & the section reduced to about a quarter; below this spot there was superficial melting of the alumina.

4) The bottom separate section was cracked around at the change in section.

5) The bottom end of the centre winding had broken off with indication of melting or shown — may have been cracked originally.
This furnace was dismantled in Minneapolis & took the core to show Coors - now lost in my last suitcase. It had cracked in the usual way in the first heating cycle. The remainder had been sent back to Canberra at the same time as 002 and fitted with a Bendigo core, made with longer bottom winding & shorter centre winding, and new fully ASTM insulation. Returned to Minneapolis 30/4/93. It was reported "not to have broken" (D2K 15/6/93) & presumably has continued in use, changing the input taps on the transformer so as to get sufficient volts for the longer bottom winding - now can get to 1300°C using less current than with the shorter bottom winding ("based on a single run").

Returned to us 7/7/93.
Coors core ground out to ø 22, standard length 150 (had to shorten 1.12 from Coors overlength)
Titanium sleeve 21 ID, 22 OD fitted full length to core. Sliding fit.
New AST insulation
Old T/C's rehabilitated
All other parts the same (bit chipped at bottom)

Top T/C 2.004
Top winding 0.6
Centre T/C 1.1
Centre winding 1.2
Bottom 1.2
Bottom winding 0.7

3.00 0.4

9/12/93

006 With double walled Coors core & new non-slip flange "top" piece 3/05-14. New AST insulation
Old T/C's & other parts

Top T/C 1.0
Top winding 0.8 0.7
Centre " 1.3
Bottom " 0.8
1LC:
Pressure effect is ~ 3.5 MPa per 1 m of confining pressure.

Furnace 006 - Returns % T/C chart to winding.
Before dismantling:
T/C Top 0.5
Center 0.6
Bottom 1.5
On dismantling:
Center T/C had 2/3 of Alumina sheath broken off & sheaf open circuit.
Alumina paper inside split in this furnace. No. Core broken (inner & outer) at bottom of bottom winding & at top of top winding.
[Edging in Potshem 004 was all coated]
Bottom T/C also had the alumina apparently corroded & some bright speck & cord on the windings part of core.

SAHD segments appear to have twisted, or at least two of them have!
Rôdsen
009 has aluminium regen packed inside,
011 does not

14/11/94

Furnace 006 refurbished.
3 new TC’s, modified design, shorter by 1/2
New tap winding
New SAF/1
Maco broken, up to 5 pieces in one segment.
Resistance (2008 0.2):

T/C          0.6
            0.7
            0.8

Winding      0.5
            1.0
            0.5
THE REMAINING PAGES
IN THIS NOTEBOOK
ARE BLANK
With Instron on, zero = 376 mV, move a lens at arm of diff cap
formed 90° voltage → 200 mV
If turn off power, goes to near zero.
still same min position (90°) of diff cap.

Put in bottle pressure, zero → 391 mV

P/1 evening:

When turned on machine, got 172 mV without Instron on, which goes to near zero when connected to CRO, or connect earth to CRO, i.e. signal goes if earth one side.
After warming up, 176 mV.

Turned on Instron, now 368 mV, group if earth one side, on other side
264 mV on earth side, unaffected by earthing either side, unless connected to CRO when it takes out signal if live is earoched.

When turn off Instron, 170 mV in 60 cycle.

Took off

Reconnected Instron plug — first put in 1, 2, 3, 14, 15 — got a high voltage.
— then connected 4, 5, 7, 10 — now 3.84 V
— checked 12C — cage & R seemed OK
— then had 134 mV, but no response to load.
moved diff cap to centre, now → 75 mV but still no load response
switched off Instron → 135 mV
— removed 14 terminal → 29 mV.

Plugged in primary again, now 200, 370 mV, → 340 mV.

Turned off Instron, have 26 mV.
— CRO load, down for 200 mV, reasonably clean signal.

Taking off voltmeter leads gave no change in Instron reading.
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Taped together