

PUNCH ASSEMBLY

A. INSTALLATION OF RING C INTO A AND B (Figure A-1)

During the assembly of A-B, no appreciable stresses are induced since a very small force, if any, is required during its installation. (Ref. Figure A-10.)

Interference between Ring C and Ring A-B assembly is 0.008 inch on the radius. Its contact pressure is given by

$$P = \frac{E \delta}{b} \frac{(b^2 - a^2)(c^2 - b^2)}{(2b^2)(c^2 - a^2)}$$

$$= \frac{29 \times 10^6 \times 0.008 (\overline{2.15^2} - \overline{1.40^2})(\overline{3.50^2} - \overline{2.15^2})}{2.15 (2) (\overline{2.15^2})(\overline{3.50^2} - \overline{1.40^2})}$$

$$= 23,000 \text{ psi}$$

1. Stresses

At o.d. of Ring A:

$$f_t = \frac{b^2 P}{c^2 - b^2} \left(1 + \frac{c^2}{r^2} \right) = \frac{\overline{2.15^2} (23,000)}{\overline{3.50^2} - \overline{2.15^2}} \left(1 + \frac{\overline{3.50^2}}{\overline{3.50^2}} \right)$$

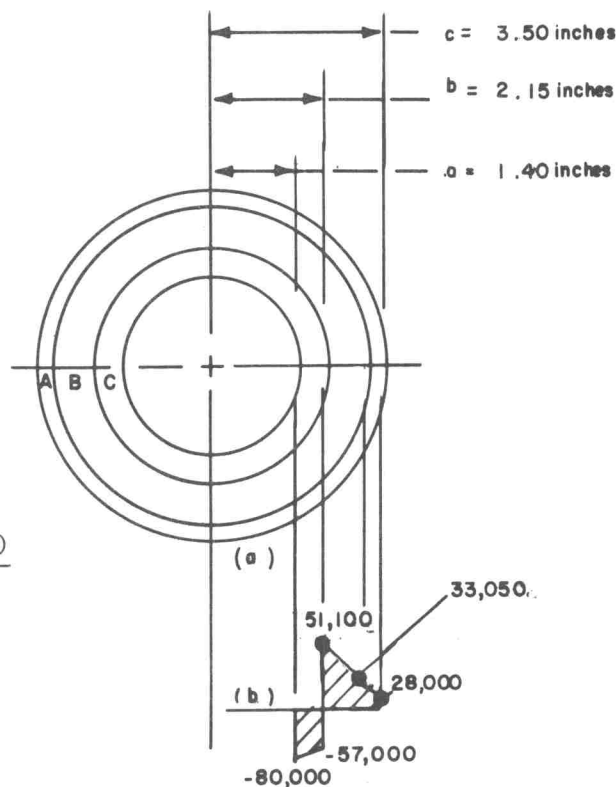
$$= 14,000 (2) = 28,000 \text{ psi}$$

At A-B Interface:

$$f_t = 14,000 \left(1 + \frac{\overline{3.50^2}}{\overline{3.00^2}} \right) = 33,050 \text{ psi}$$

At B-C Interface:

$$f_t = 14,000 \left(1 + \frac{\overline{3.50^2}}{\overline{2.15^2}} \right) = 51,100 \text{ psi}$$



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Figure A-1 STRESS DISTRIBUTION DURING INSTALLATION OF RING C INTO A AND B

$$f_c = \frac{b^2 p}{(b^2 - a^2)} \left(1 + \frac{a^2}{r^2} \right) = \frac{2.15^2 (23,000)}{(2.15^2 - 1.40^2)} \left(1 + \frac{1.40^2}{2.15^2} \right)$$

$$= 57,000 \text{ psi}$$

At i. d. of Ring C:

$$f_c = 40,000 \left(1 + \frac{1.40^2}{1.40^2} \right)$$

$$= 80,000 \text{ psi}$$

These stresses are plotted as shown in Figure A-1(b).

2. Strain Gage Data

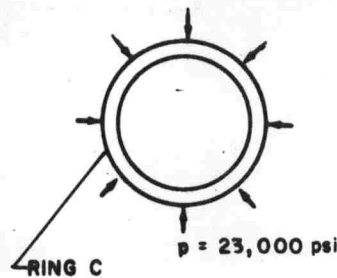
From Table A-I an average reading of 30,300 psi was recorded. (Readings indicate that strain gage No. 4 yielded higher values than the other three gages and showed up especially when Ring D was installed. Therefore, it was not included in the average value.) A 7.6 percent difference existed between the calculated (28,000 psi) and test (30,300 psi) values. It was concluded that these values are close enough for our intents and purposes.

3. Radial Displacement of i. d. Of Ring C Due To Ring C Installation (Figure A-2)

$$\delta = \frac{2 (b^2 p)(a)}{E (b^2 - a^2)} = \frac{2}{29 \times 10^6} \frac{(2.15^2 \times 23,000) (1.40)}{(2.15^2 - 1.40^2)}$$

$$= 0.0038 \text{ inch}$$

This deflection is added to the existing interference (before assembly) of Ring D.



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Figure A-2 RADIAL DISPLACEMENT OF i.d. OF RING C DUE TO RING C INSTALLATION