SAE Aerospace
An SAE International Group

AEROSPACE INFORMATION REPORT

SAE AIR5615

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# Procedure for Determining the Dimensional Relationship of Rotating Components Coupled with Thrust Wires

RATIONALE

AIR5615 has been reaffirmed to comply with the SAE five-year review policy.

## 1. SCOPE

The scope of this SAE Aerospace Information Report (AIR) is to define recommended methods of determining the optimal dimensional relationship of components coupled together using thrust wires for applications such as coupling nuts and fittings.

These design parameters are intended to optimize component loading characteristics and maximize wire shear capabilities for both high and low pressure applications.

### 1.1 Application

The equations presented herein were developed for use with parts requiring a swiveling action in relation to each other and still retain an axial load capability. The most prevalent application would be the attachment of coupling nuts on hydraulic tube fittings and hose assemblies.

Thrust wire lengths and insertion depths used with the designs herein should be determined using ARP4988.

## 2. REFERENCES

### 2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect of the date of the purchase order. In the event of a conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

#### 2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

ARP4988 Procedure for Determining Thrust Wire Lengths and Minimum Insertion Depths

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### 2.2 Definitions

The equations presented herein were developed using the following parameters:

A = Inner Component Major Diameter

B = Inner Component Wire Groove Diameter

C = Inner Component Wire Groove Radius

D = Outer Component Minor Diameter

E = Outer Component Wire Groove Diameter

F = Outer Component Wire Groove Radius

G = Outer Component Wire Groove Width

#### 2.2.1 Wire Diameter

Thrust wire diameter is assumed to be selected based on joint strength requirements.

## 3. ASSUMPTIONS AND DERIVATIVE EQUATIONS

Refer to Figure 1 for a pictorial description.

Following are the assumptions and premises used in the development of empirical equations:

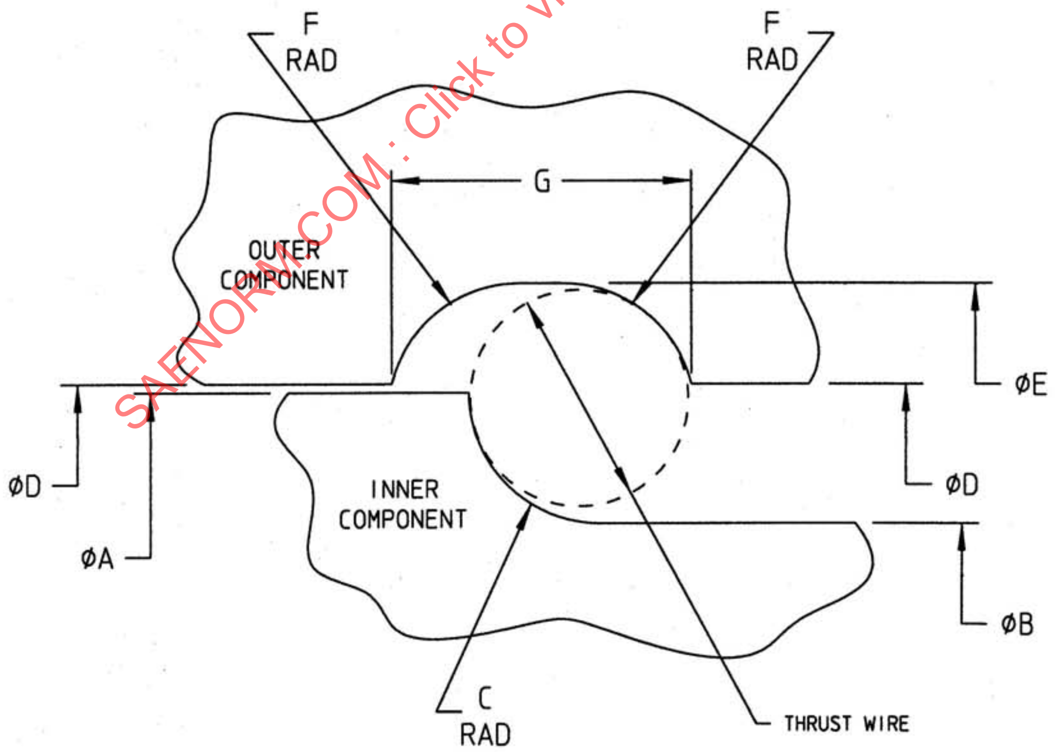


FIGURE 1 - WIRE/COMPONENT RELATIONSHIP

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3.1 Inner Component Major "AØ"

The component diameter "A" should be very close fitting to the outer component minor diameter "D" in order to maximize wire shear and restrict the allowable axial mislocation of the male and female fittings.

3.1.1 The minimum diameter "A" / diameter "D" diametral clearance should be restricted to .001 for "D" diameter of .125 and .004 for a "D" diameter of 1.25. Using this slope the following equation results:

$$A\varnothing = [D\varnothing \text{ Min.} - (0.0022(D\varnothing \text{ Min}) + .0028)] \text{ Rounded .XXX} \quad \text{(Eq. 1)}$$

Tolerance on AØ = ±.002

3.2 Inner Component Wire Groove "BØ"

The groove diameter "B" should be as large as possible in order to maximize material strength, allow the largest possible I.D., and prevent the wire from shrinking down out of the outer component groove when under axial load. This must be tempered by the need for wire clearance to allow the outer component to swivel, and to maximize the wire groove radius "C" which we will describe next.

3.2.1 The inner component groove diameter should have at least a .009 diametral clearance.

3.2.2 A factor of 10% of the minimum wire diameter should also be allowed for clearance.

$$B\varnothing = [A\varnothing - 1.1(\text{Minimum Wire } \varnothing) - .009] \text{ Rounded .XXX} \quad \text{(Eq. 2)}$$

Tolerance on BØ = ±.002

3.3 Inner Component Wire Groove Radius "C"

The wire groove radius "C" should be 1/2 the maximum wire diameter in order to further prevent the wire from shrinking down out of the nut groove, provide the lowest corner stress, and provide the most rapid wire bearing surface area, as deformation occurs in the shoulder.

3.3.1 Radius "C" is tangent to "BØ".

3.3.2 A 10% factor is added in the "BØ" calculation to assure that shoulder will have a small flat to engage the wire surface as close as possible to wire center line. This small flat will deform and load radius "C" as tension increases.

3.3.3 In order to assure that an odd wire diameter will round down, a factor of .497 is used instead of .500.

$$\text{Radius C} = [.497 (\text{Maximum Wire } \varnothing)] \text{ Rounded .XXX} \quad \text{(Eq. 3)}$$

Tolerance on Radius C = ±.004

3.4 Outer Component Minor "DØ"

The outer component minor diameter "D" is assumed to be the known starting point for the equation herein. If the known starting diameter is the inner major diameter, then the equations need adjusting to derive "D" instead of "A".

$$D\varnothing = \text{As assigned} \quad \text{(Eq. 4)}$$

Tolerance on DØ = As assigned

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