

# Human Factor Requirements

Field of View (FOV)  
Fogging  
Communications

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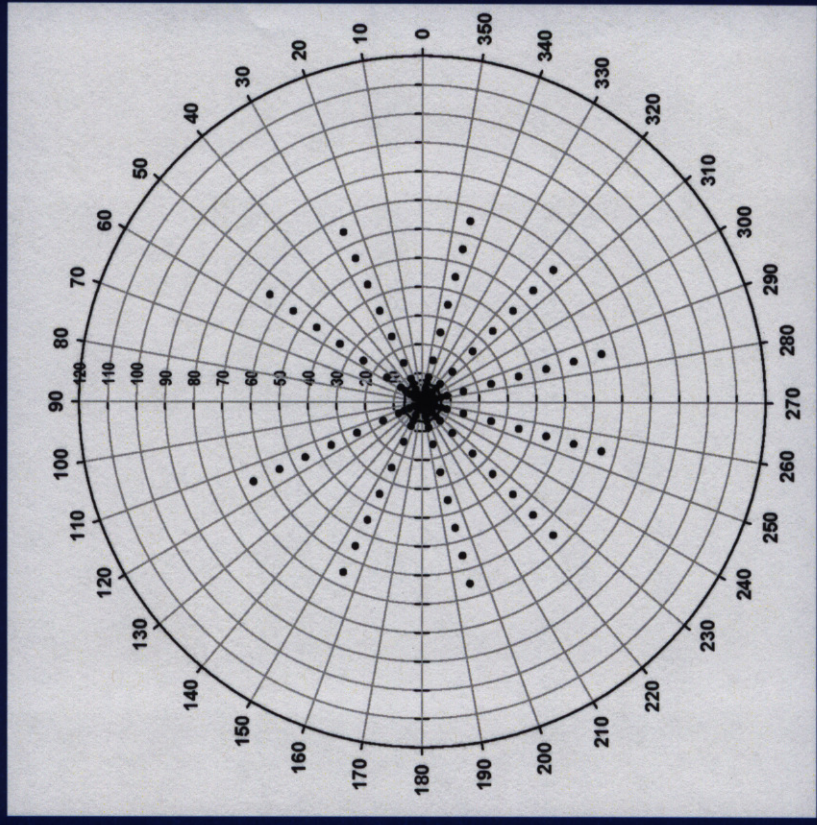
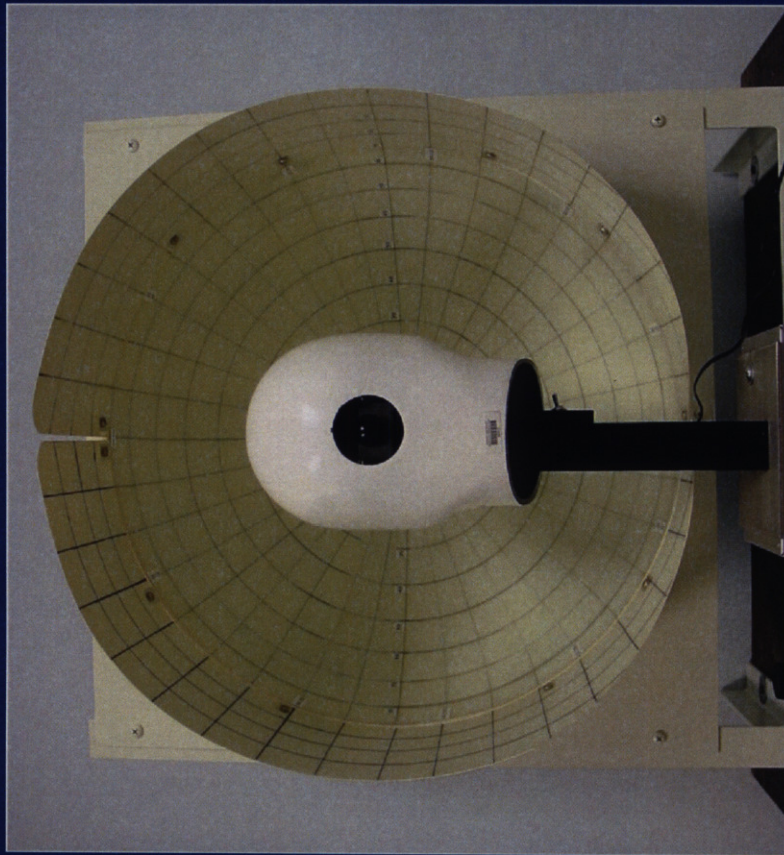


# Field of View (FOV)

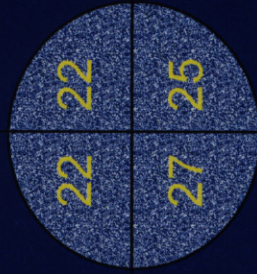
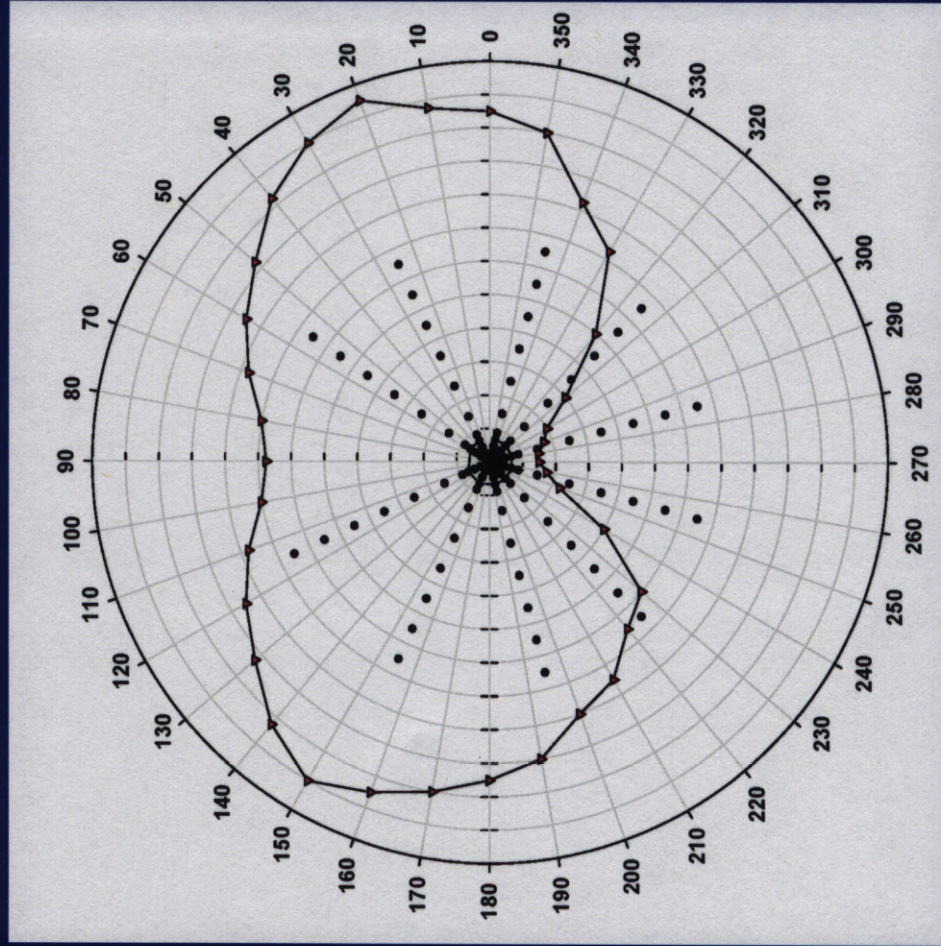
- Requirement:
  - Visual Field Score (VFS)  $\geq 70$
  - 1 Respirator that anatomically best fits the Head Form of the Apertometer of EN 136: 1998 or equivalent; VFS = Average Score of 3 Fittings
  - Derived From: *AMA Guides*; Functional Impact of VFS=70 Translates to Mild Visual Impairment (Requires Scanning For Obstacles)



# FOV Test Equipment and Methodology



# Example: Escape Hood Respirator 1: Fit 1.



VFS = 96

# Field of View Test Results

Escape Respirator	VFS FIT 1	VFS FIT 2	VFS FIT 3	VFS Avg.
Concept 1	96	96	92	94.7
Concept 2	103	104	102	103
Concept 3	93	94	93.3	93
Concept 4	97	98	99	98



# Fogging Test Conditions and Equipment

- 2 Environmental Test Conditions:
  - Low Temp Chamber -10.5 °C (13°F)
  - Hot Humid Chamber 32.2 °C (90 °F); RH @ 60%
- 3 Visual Acuity Scores will be Taken
  - 1. Respirator Donned in ambient condition 22.2 °C (72 °F)
  - 2. Immediately Upon enter into Environmental Chamber
  - 3. During 2 min Rest Period after 5 min of Exercise
- Test Equipment
  - Environmental Chamber
  - Treadmill
  - Snellen Logarithmic Low Acuity Chart 2000 @ 40cm

# Fogging Resistance Requirement

- Number of Tests: 2 Tests per Environmental Condition
- 2 Different Human Subjects per Environmental Condition (Same Human Subject Allowed for Cold and Hot/Humid)
- $$\text{Avg. } VAS_{\text{Chamber}} = \frac{VAS_{\text{Chamber}(1)} + VAS_{\text{Chamber}(2)}}{2}$$
- $$\text{PR}(\%) = \left( \frac{\text{Avg. } VAS_{\text{Chamber}}}{VAS_{\text{Ambient}}} \right) \times 100$$
- All 4 Performance Ratings (%)  $\geq 70\%$



# Sample Fogging Test Results

Cold Chamber Condition = -11.6 °C (11 °F)  
 Avg. Ambient = 24.3 °C (75.8 °F); RH = 46.1%

Model	VAS Ambient	1 <sup>st</sup> VAS In Chamber	2 <sup>nd</sup> VAS In Chamber	PR (%)
Model A	95	90	85	92
Model B	95	95	60	82
Model C	105	100	100	95
Model D	90	75	60	75





# Sample Fogging Test

Hot/Hum Chamber Condition 30.7 °C (87.4 °F)/ RH = 68.2%  
 Avg. Ambient = 27.2 °C (81.9 °F)

Model	VAS Ambient	1 <sup>st</sup> VAS In Chamber	2 <sup>nd</sup> VAS In Chamber	PR (%)
Model A	100	85	85	85
Model B	105	90	40	62
Model C	105	95	95	90
Model D	100	100	90	95



# Communication Requirement

- The Communication (Speech Intelligibility) capability is an Optional Feature
- If Communication Feature NIOSH Qualified:
  - Requirement:  $\geq 70\%$



# Communication Methodology

- Modified Rhyme Test (MRT)
- Background Noise = 60 dBA  $\pm$  2 dBA consisting of a broadband “pink” noise
- Distance = 10 FT (3.1m)
- 10 MRT Trials, Yielding:
  - 15 MRT Scores per listener with Respirator and 15 w/o respirator ; (3 Listeners, 5 Speakers)

# Communication MRT Data

	Concept X	Concept Y	Concept Z
Escape Respirator	63	63	64
Background Noise	36	45	36
Avg PR(%)	18	11	16
Min PR (%)	24	32	11
Max PR (%)	51	66	78

# Summary / Conclusion

- Field of View (FOV)
  - Requirement: VFS  $\geq$  70 Points
  - Same FOV STP as NIOSH CBRN Full Facepiece Gas Mask
- Fogging
  - Requirement: PR(%)  $\geq$  70 %
  - Conditions: Don at 22.2 °C (72 °F) and enter Low Temp -10.5 °C (13 °F) and Hot Humid 32.2 °C (90 °F); RH @ 60%
- Communications
  - Requirement: Optional
  - For Communication Qualifier, Requirement  $\geq$  70%
  - Same Communication STP as NIOSH CBRN Full Facepiece Gas Mask

