

# RAIL VEHICLE END OF CAR HOSE FLEXIBILITY TESTING

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# Overview

- Introduction
  - AAR, BSC and Hose TAG
- AAR M-601 Specification
- Former Test Method
- Development of New Test Method
- New Test Procedure
- Test Results of Hoses from Various Manufacturers
  - Former Method, Proposed Methods and New Method
- Acknowledgements
- Questions

# AAR & BSC

- Association of American Railroads (AAR)
  - Promulgates and publishes the “Manual of Standards and Recommended Practices (MSRP)”
    - Standards for components used on vehicles operating in interchange service in North America
- The Brake Systems Committee (BSC) of the AAR
  - Maintains & updates Section E of the MSRP
  - Received complaints of difficulties coupling hoses during cold weather
  - Wanted to test hoses directly from warehouse stock
  - Traditional test method required specially prepared test samples
  - Revision to the existing specification was deemed necessary

# Hose TAG



- The BSC saw a need to upgrade hose specifications.
- Directed the Hose Manufacturers and Assemblers to form a group to review current standards and formulate proposals for revisions.
- Hose Technical Advisory Group
  - Hose TAG

# AAR M-601

- Rail Car End Hoses
  - Requirements for:
    - Material / Construction
    - Performance
    - Etc.
  - Flexibility
    - Must not be too soft in Summer
      - Hose may kink and restrict air flow
    - Must not be too stiff in Winter
      - Carmen have difficulties coupling hoses together



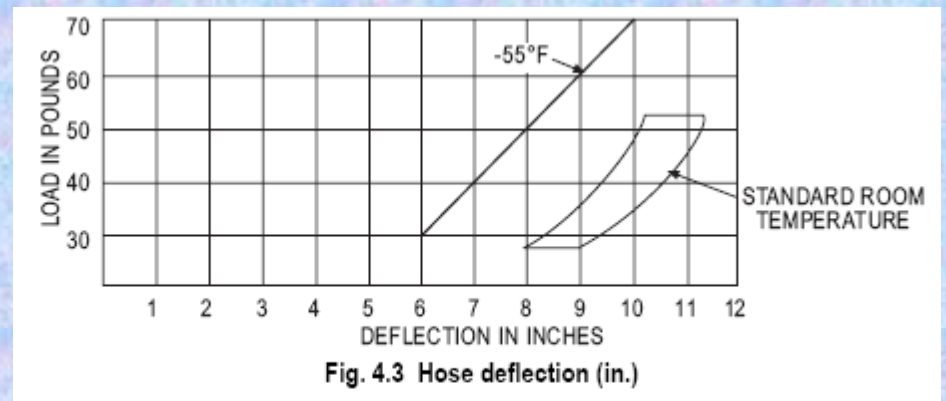
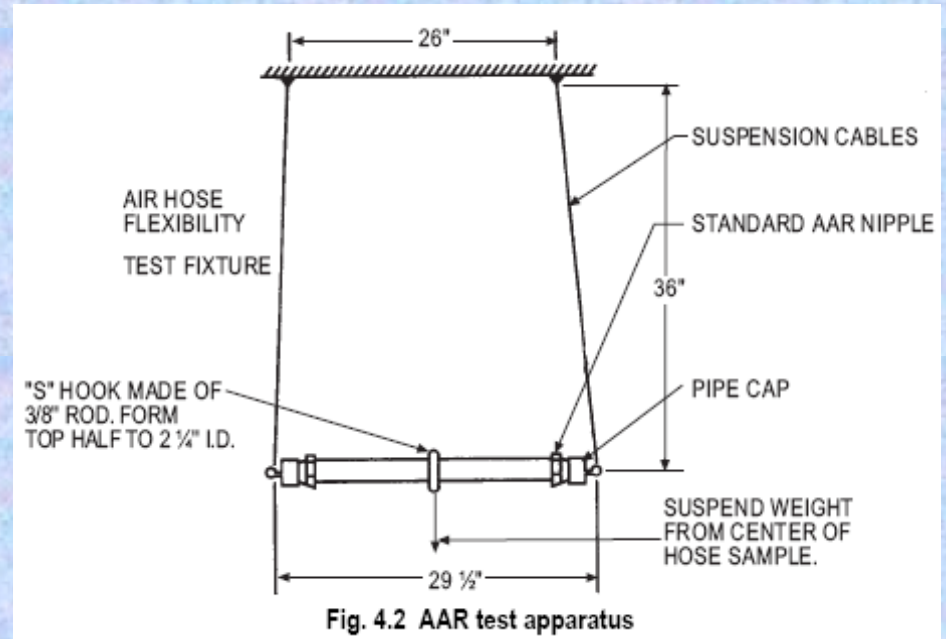
# Original Test Method

- Conducted at two different test temperatures

70° F

-55° F

- Displacement vs. Load measurements



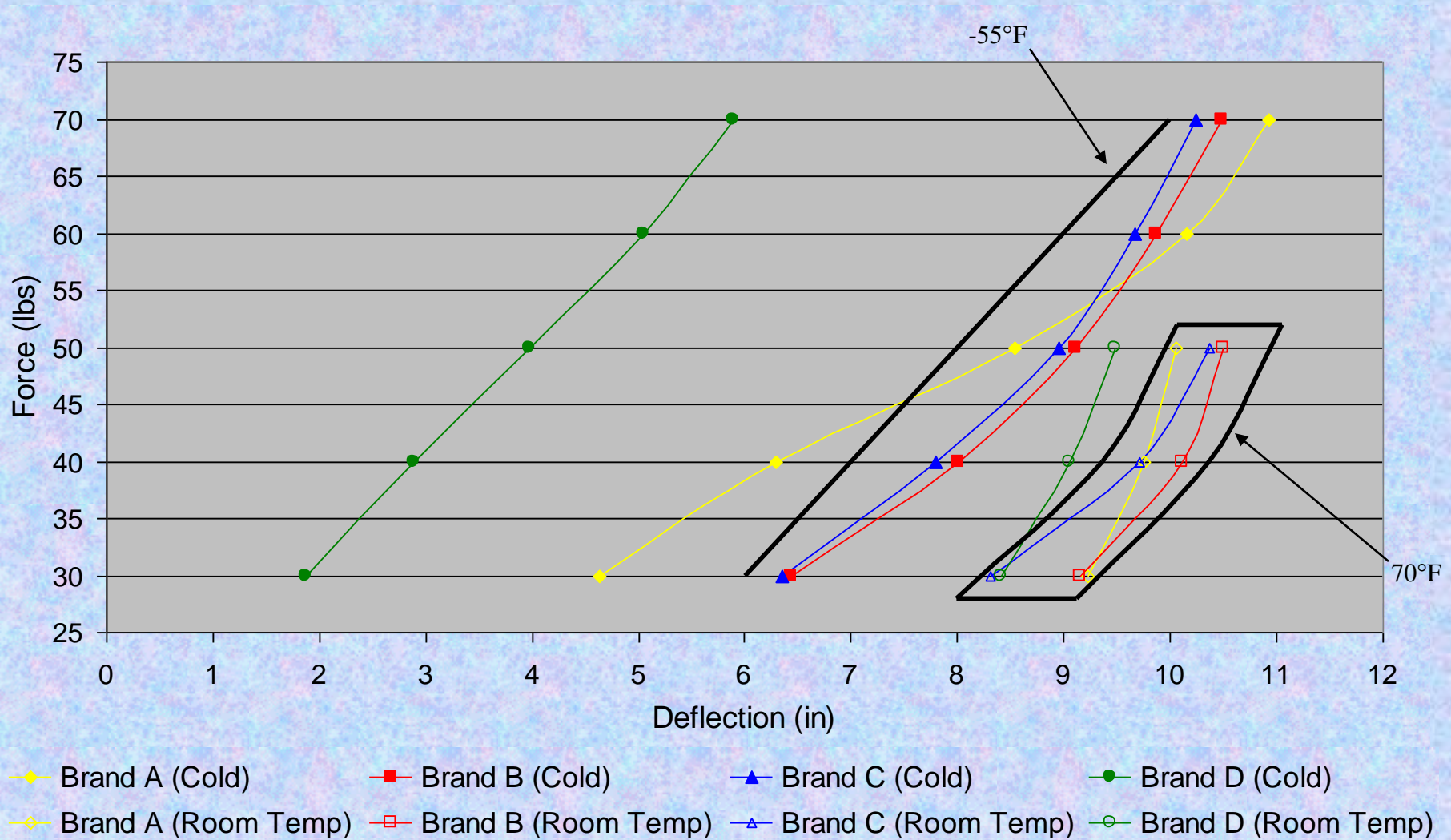
# Original Test Method

- Two techniques for testing at  $-55^{\circ}\text{F}$ 
  - Walk-in Cold Chamber
  - Cold Chest / Warm Room



# Test Results: Original “Suspension” Method

Male Pipe Thread x Male Pipe Thread Hose Assembly

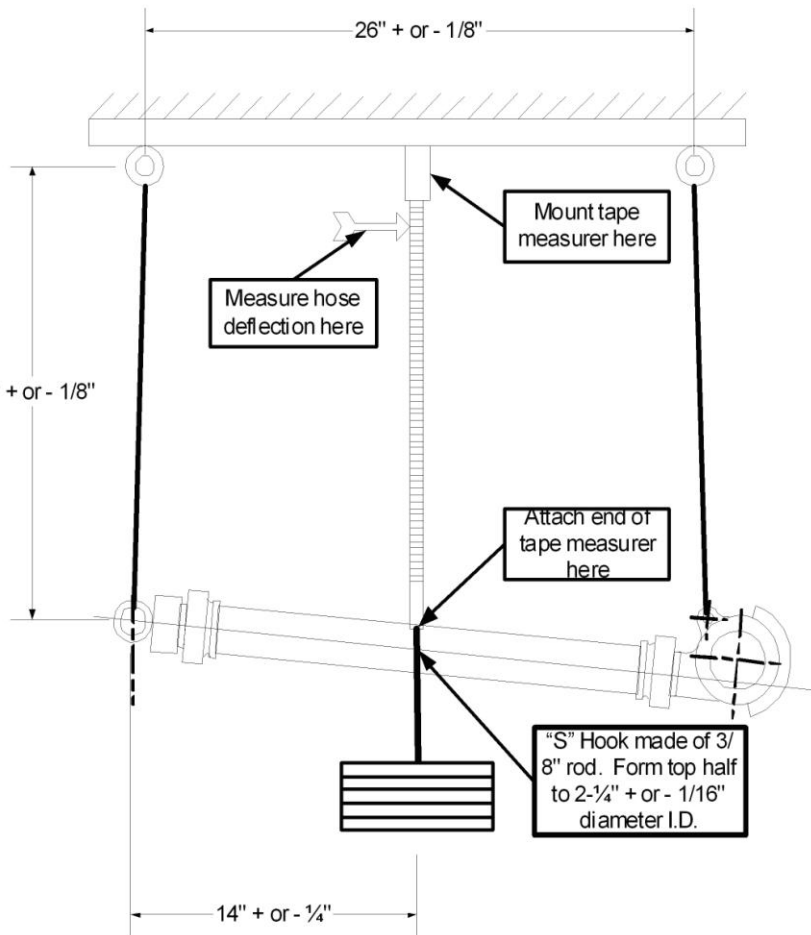


# Shortcomings of Original Method

- Special hose assemblies needed
  - Male Pipe Thread x Male Pipe Thread
  - Cannot test hose assemblies from inventory
    - No verification of production hose assemblies
- Walk-in cold chamber
  - Expensive equipment
  - Harsh working environment
    - Operators can only spend a few minutes at a time in the chamber
    - Multiple operators needed to conduct testing in timely manner
- Cold Chest / Warm room
  - Time sensitive procedure
  - Results may vary

# Development of New Test Method

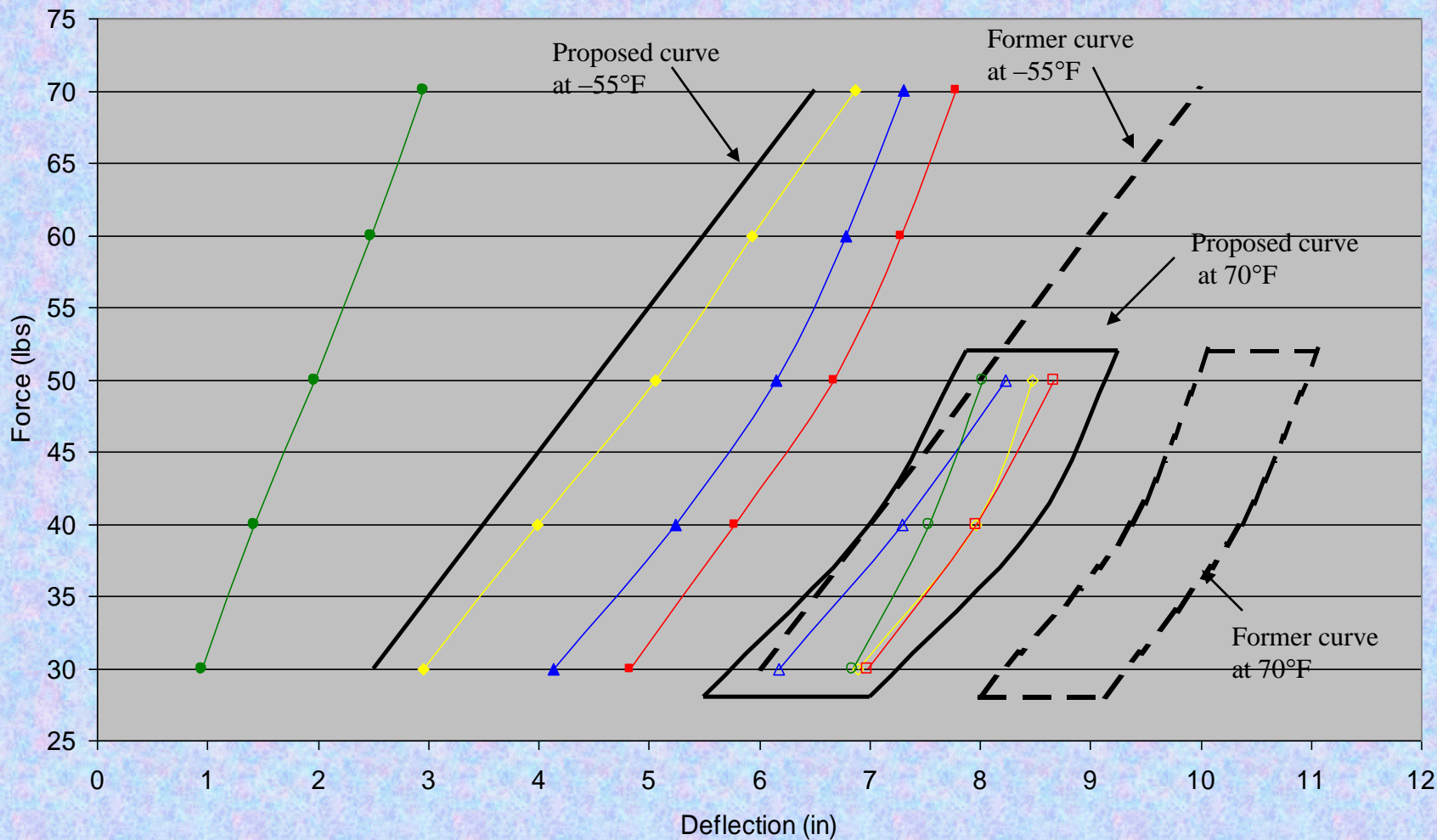
## Proposed “Suspension” Method



- Suspension Method
  - Test procedure identical to former test method
- Use Male Pipe Thread x Gladhand hose assembly
  - No special hose assemblies required

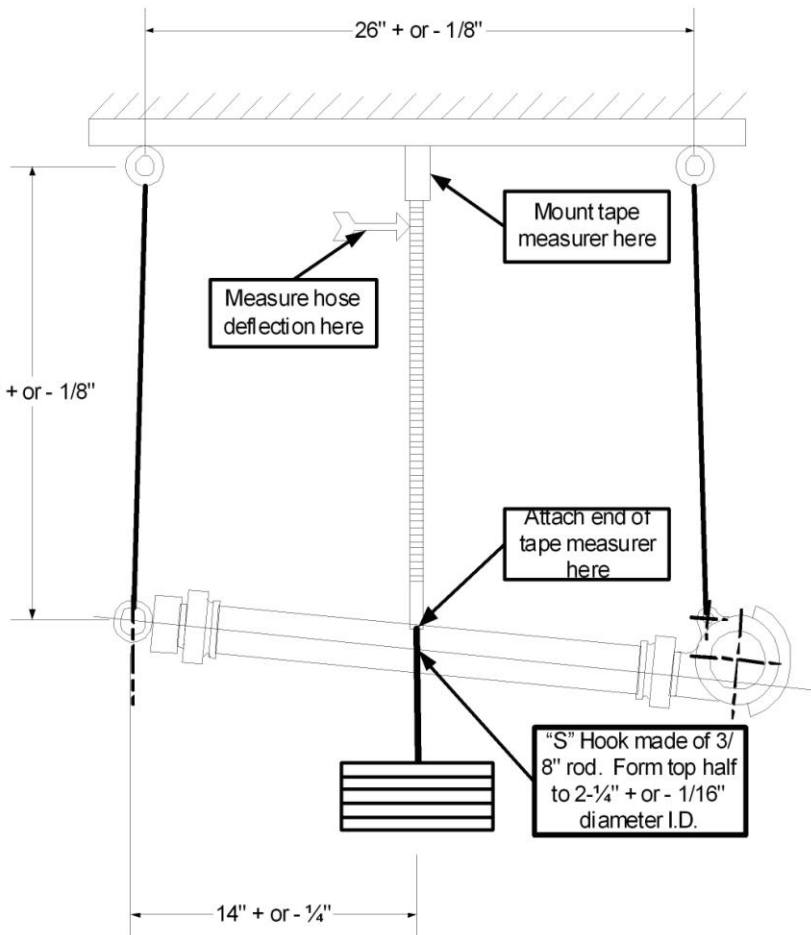
# Test Results: Proposed “Suspension” Method

## Male Pipe Thread x Gladhand Hose Assembly



- ◆ Brand A (Cold)
- Brand B (Cold)
- ▲ Brand C (Cold)
- Brand D (Cold)
- ◇ Brand A (Room Temp)
- Brand B (Room Temp)
- △ Brand C (Room Temp)
- Brand D (Room Temp)

# Shortcomings of Proposed “Suspension” Method

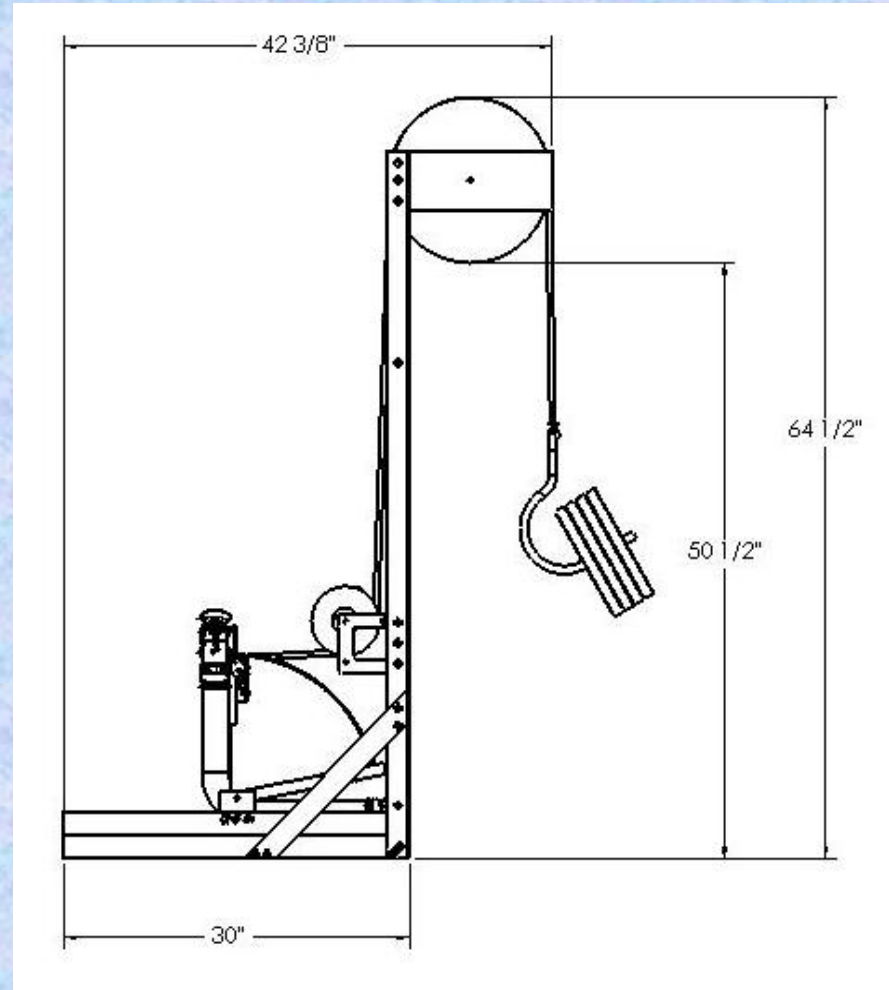


- Walk-in cold chamber
  - Expensive
  - Harsh working environment
- Or
- Exposure to warm air using chest freezer
  - Unreliable test results

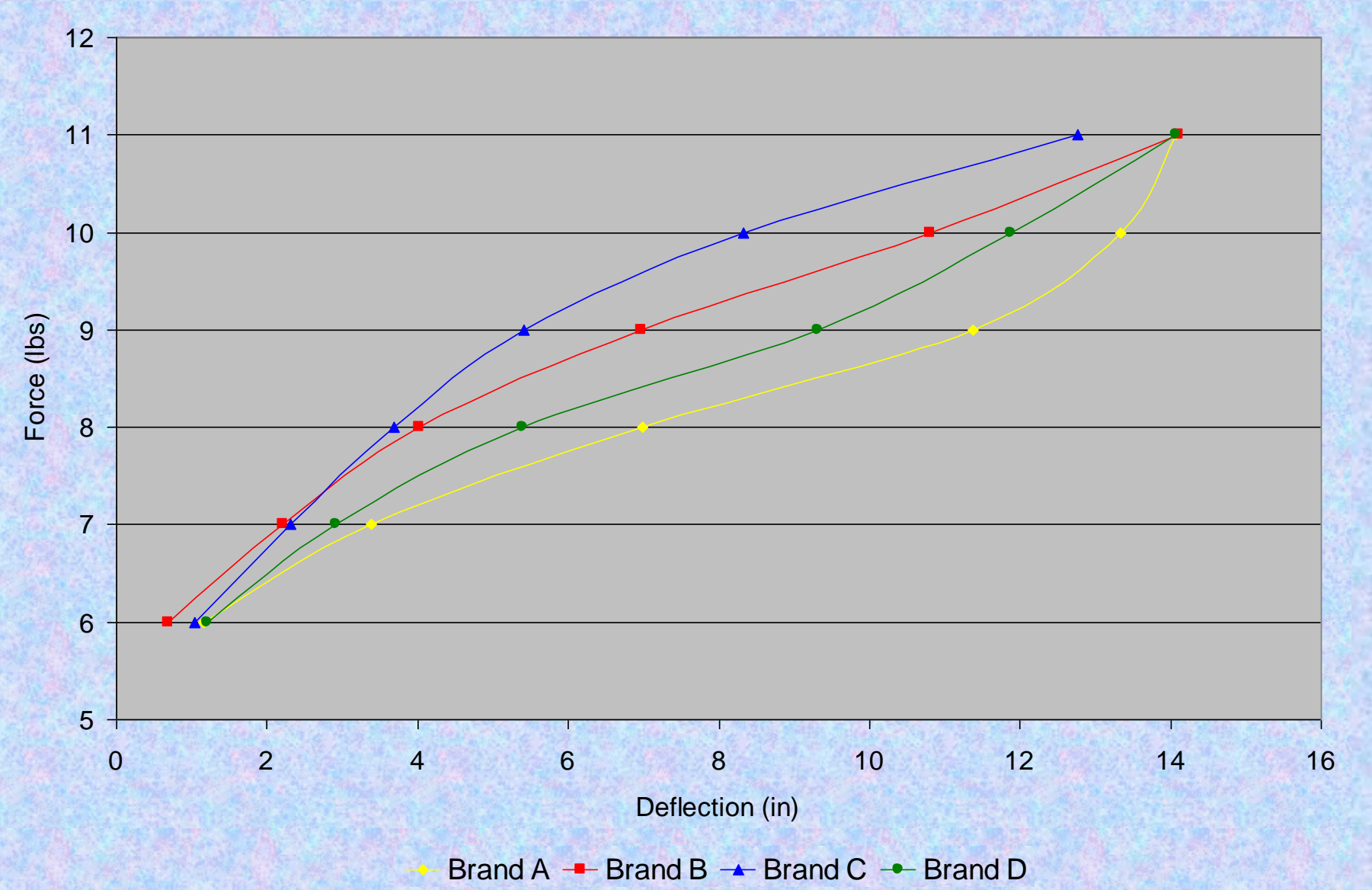
# Development of New Test Method

## Proposed “Cobden” Test Device

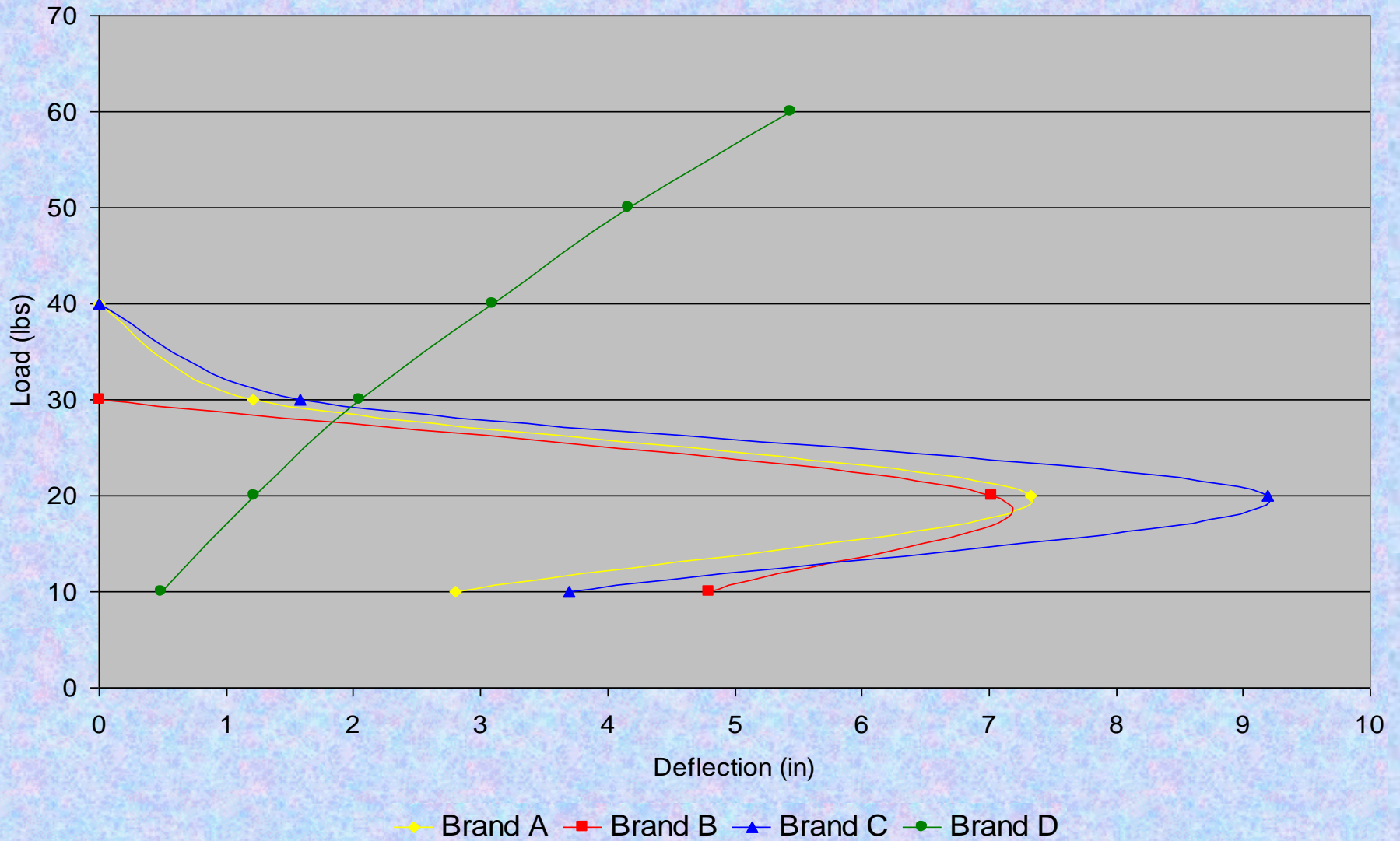
- Measure Force vs. Displacement
- No special hose assemblies needed
- Can be used in chest freezer
  - Reduced exposure to warm air
  - Comfortable working environment for operators



# Test Data: Proposed “Cobden” Method at 70°F

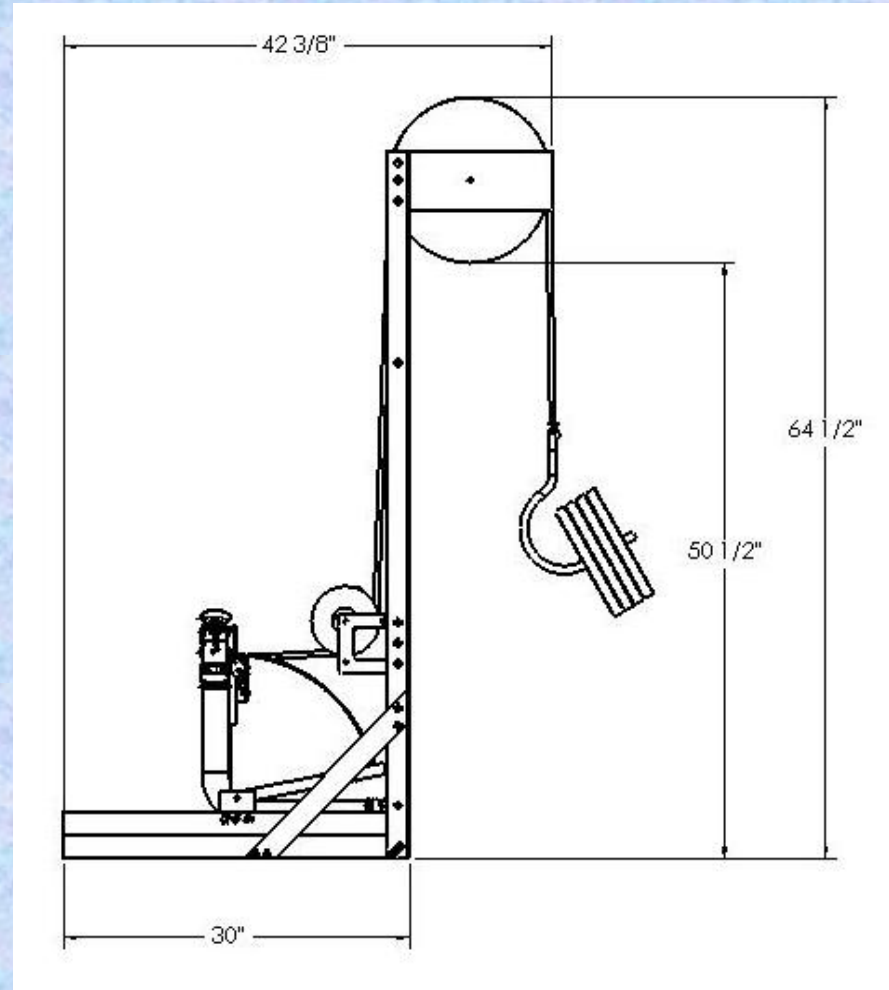


# Test Data: Proposed “Cobden” Method at $-55^{\circ}\text{F}$



# Shortcomings of Proposed “Cobden” Method

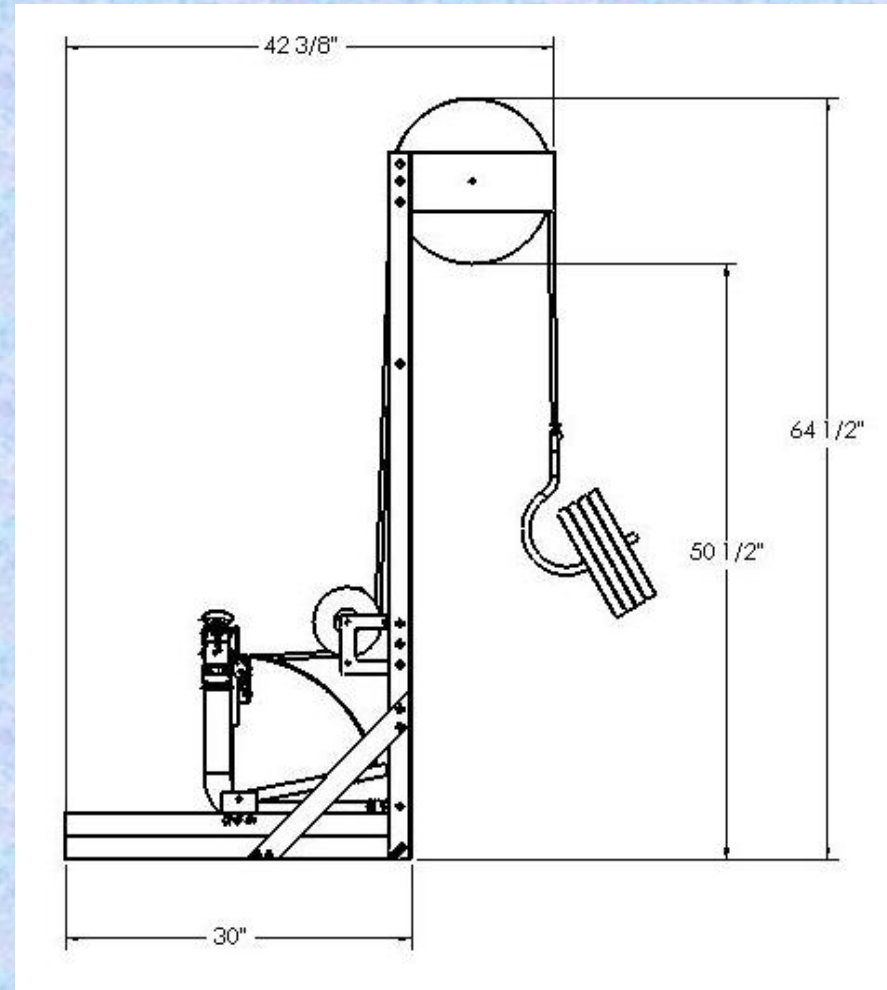
- Measurement of displacement is difficult
  - Creep
  - Poor Repeatability



# Development of New Test Method

## “Cobden” Test Device

- Kink Method
  - “Kink” defined as maximum rotation of cam
    - At 70°F hose must NOT kink when a specific load is applied
    - At -55°F hose MUST kink when a specific load is applied



# Advantages of “Cobden” Kink Method

- More closely simulates the actions of a carman flexing hoses to couple them in the field
- No special hose assemblies are needed
  - Hose assemblies from a production lot can be tested.
- Low temperature tests can be conducted in a cold box with reduced exposure of test specimens to warm air
  - No expensive walk-in chamber needed
    - cost savings
  - No harsh working environment for the test operator(s)
    - Reduced operator fatigue
    - Test can be conducted in a more timely manner
- Simple Pass / Fail test criteria
  - Force vs. Deflection measurements are not needed
  - One load applied
    - Further reduction in test time

# AAR M-601 Final Approved Test Procedure: “Cobden” Kink Method

- At  $70^{\circ}\text{F} \pm 2^{\circ}\text{F}$ , the application of a **9 lb** weight *must not* produce kinking of the hose within 30 seconds, as evidenced by maximum rotation of the cam.
- For the cold temperature test, the hose samples must be held at  $-55^{\circ}\text{F} \pm 2^{\circ}\text{F}$  for 48 hours, the steady application of weights totaling **40 lb** *must* produce kinking of the hose within 30 seconds, as evidenced by maximum rotation of the cam.

# Test Results Comparison

## Original and Proposed Methods

SAMPLE	"Cobden" Kink Method		Original Suspension Method Male x Male		Proposed Suspension Method Male x Gladhand	
	70° F	-55° F	70° F	-55° F	70° F	-55° F
A	Pass	Pass	Pass	Pass	Pass	Pass
B	Pass	Pass	Pass	Pass	Pass	Pass
C	Pass	Pass	Pass	Pass	Pass	Pass
D	Pass	Fail	Fail	Fail	Pass	Fail

# Test Summary

- Carman's ability to bend the hose is seen to be the limiting factor in determining hose acceptability
- Acceptable force(s) for bending hoses at a given temperature was determined by testing currently approved hose manufacturers
- Four Hose manufacturers identified as Brands A, B, C, & D were tested
  - Brands A, B, C and D performed similarly for the Former & Proposed Test Methods
  - Brand D remained very stiff for the Former & Proposed Test Methods
  - Repeatable results between Former and Proposed Test Methods
- The Failure Criteria for testing at  $-55^{\circ}\text{F}$  and  $70^{\circ}\text{F}$  was simplified to two applied loads

# Acknowledgements

- *Ellcon National* - Provided use of walk-in cold chamber and testing participation.
- *Hose TAG* – Group review of proposed and final testing procedures.
- *NYAB* - Provided use of walk-in cold chamber and testing participation.
- *Premtec* - Testing participation.
- *TTCI* - Test witnessing and test participation.

Questions?