# ISO 11228-2:2007-04 (E)

## Ergonomics - Manual handling - Part 2: Pushing and pulling

## Contents

Page


Foreword ..... iv

Introduction ..... v

1 Scope ..... 1

2 Terms and definitions ..... 1

3 Recommendations ..... 2
3.1 Avoiding hazardous manual handling tasks ..... 2
3.2 Risk assessment ..... 2
3.2.1 Hazard identification ..... 3
3.2.1.1 Force ..... 3
3.2.1.2 Posture ..... 3
3.2.1.3 Frequency and duration ..... 4
3.2.1.4 Distance ..... 4
3.2.1.5 Object characteristics ..... 4
3.2.1.6 Environmental conditions ..... 4
3.2.1.7 Individual characteristics ..... 4
3.2.1.8 Work organization ..... 5
3.2.2 Risk estimation and risk assessment ..... 5
3.2.2.1 Method 1 -- Generalized risk estimation and risk assessment approach ..... 5
3.2.2.2 Method 2 -- Specialized risk estimation and risk assessment approach ..... 7
3.2.2.2.1 Part A -- Muscle-strength-based force limits, FBr ..... 8
3.2.2.2.2 Part B -- Skeletal-based force limits, FLS ..... 9
3.2.2.2.3 Part C -- Limiting force, FL ..... 9
3.2.2.2.4 Part D -- Safety limit, FR ..... 9
3.2.3 Risk reduction ..... 10

Annex A (informative) Method 1 -- Pushing and pulling: general assessment checklist ..... 11

Annex B (informative) Method 2 -- Specialized risk estimation and risk evaluation ..... 20

Annex C (informative) Risk reduction methods ..... 40

Annex D (informative) Suggested approach for measuring push/pull forces ..... 44

Annex E (informative) Application examples for Methods 1 and 2 ..... 45

Annex F (informative) Method for determining combined strength distribution for a particular reference group ..... 55

Bibliography ..... 64