

NR12 - SAFETY IN MACHINERY AND EQUIPMENT WORK

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Risk Engineering



Course objectives

- To provide you with awareness of the NR12 Standard for Industry.
- To review common industry issues relating to this topic
- To review common solutions to issues

What is NR

- *Norma Regulamentar* or the Regulatory Standards are Occupational Health and Safety mandatory requirements that must be complied by public and private companies, public institutions and their administrations, as well as legislative authorities that have employees governed by the Consolidated Labor Laws
- NR was approved by Governmental Decree No. 3214 of June 8th, 1978,
- There are 36 NR's



Is there a need for NR?

Each year...

- Over *700,000 worker injuries in Brazil each year

and...

- Over 2700 deaths per year
- 1609 injuries per 100.000 workers
- 7.4 deaths per 100.000 workers
- Absenteeism resulted from sick leave resulted in a cost of R\$22 billion

*International Labor Organization

Pergunta 1: Quantos trabalhadores sofrem acidentes de trabalho no Brasil ?

A. Mais de 1.000.000



B. Mais de 800.000



C. Mais de 700.000



What is NR12 – Safety in machinery and equipment work

- This NR provides technical references, basic principles, and protective measures to ensure the health and physical integrity of workers and establishes minimum requirements for the prevention of accidents and occupational diseases in the design stages and use of machinery and equipment of all kinds, and also to its manufacture, importation, trading, exhibition and cession in any way, in all economic activities



The NR12 Regulation Contents

- General Principles
- Physical layout and facilities
- Installations and electrical devices
- Starting, actuation and stop devices
- Safety systems
- Emergency stop devices
- Permanent means of Access
- Pressurized components
- Material conveyors
- Ergonomic aspects

The NR12 Regulation Contents (Cont.)

- Additional risks
 - hazardous substances
 - ionizing radiation
 - Vibration
 - Noise
 - Heat
 - fuels, flammables, explosives
 - risk of burns
- Maintenance, inspection, preparation, adjustments and repairs
- Signs

The NR12 Regulation Contents (Cont.)

- Manuals
- Work and safety procedures
- Design, manufacture, importation, sale, lease, auction, cession in any way, exposure and use
- Technical training
- Other specific safety requirements
- Final provisions

Additionally there are 12 Annexes that apply to this regulation

The NR12 Regulation – Highlights

- General Principles
- Physical layout and facilities
- Installations and electrical devices
- Starting, actuation and stop devices
- Safety systems
- Emergency stop devices
- Permanent means of Access

General Principles Section

Risk Engineering

- Provides information of how the regulation is applied
- Where it is applied
- Equipment covered and excluded (new & used)
- How employers should apply the regulation
- Employee responsibilities

Priority for Controls:

1. Engineering (proteção coletiva)
2. Administrative (administrativas)
3. PPE – (proteção individual)



Physical Layout and Facilities

Risk Engineering

- traffic markings around equipment
- isles and passages clear & proper width 1.2m
- marked areas for materials
- spacing between/around equipment
- No debris
- Level and proper loading
- anchored



Pergunta 2:

Ao se analisar a disposição física e instalações de um ambiente de trabalho, quais são os principais itens a considerar?

- A. "Áreas de circulação e corredores, capacidade de carga do piso, distâncias entre equipamentos (Aisles and Passage ways, Floor Loading, Distances between equipment)"



- B. "Espaçamento entre suprimentos, altura do teto, distância até as saídas (Spacing of supplies, Ceiling height, Distance to exits)"



- C. "Distância até áreas residenciais, distâncias até corpos de água, distância até a brigada de bombeiros mais próxima (Distance to residential areas, Distances to bodies of water, Distances to the nearest fire brigade)"



Installations and Electrical Devices

Risk Engineering

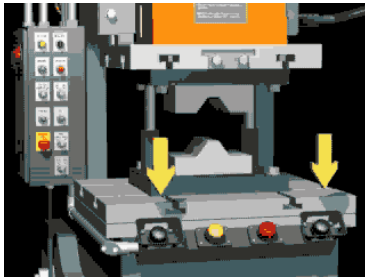
- Equipment designed and maintained to prevent risk of electrical shock, fire, explosion or other accidents as per NR10
 - Grounding
 - GFCI
 - Coverings
 - Guarding
 - Warnings
 - Obstructions
 - Batteries



Starting, Actuation, and Stop Devices

Risk Engineering

- Design of start/stop devices
- Safeties
- Two handed controls
- Multiple persons controls

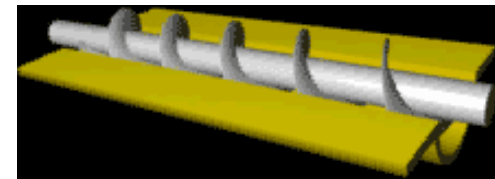
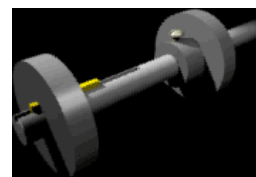
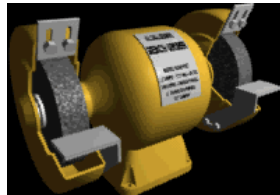
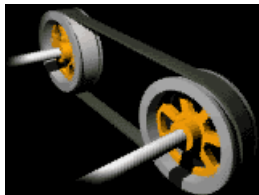
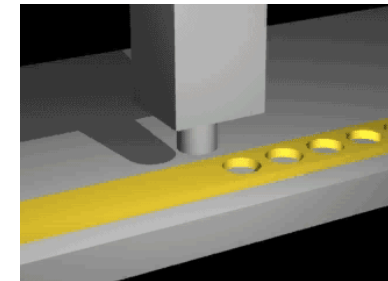
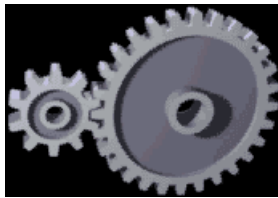
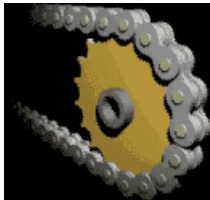
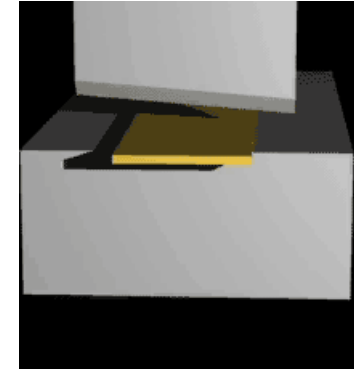
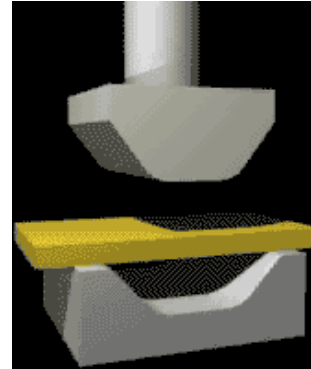


Source: OSHA




Safety Systems

Risk Engineering

- Discusses Guards, Interlocks, Sensors
- Danger zones of equipment
 - Conduct Risk Assessment
 - By qualified professional
 - Technical compliance
 - Monitored per safety category
 - Stop dangerous movement

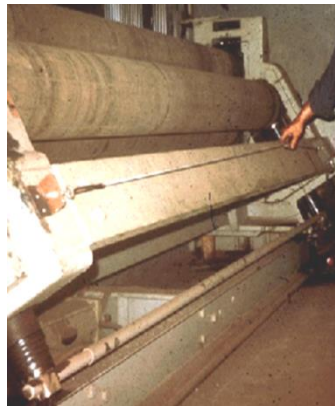
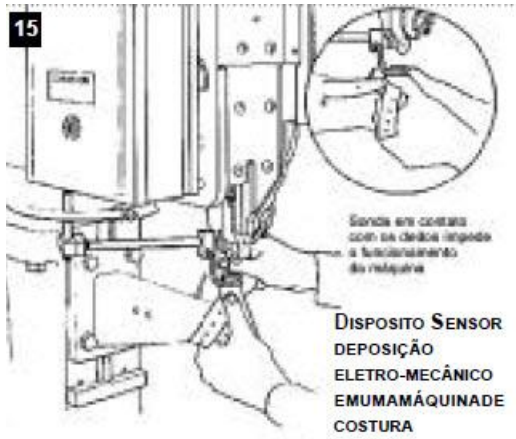
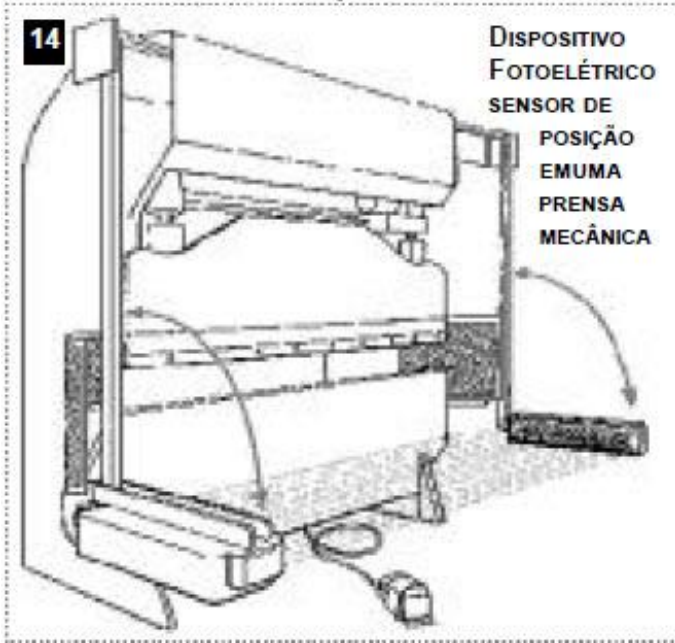


Pergunta 3: Ao se analisar sistemas de segurança, deve-se considerar

- A. "Proteção por barreiras físicas(Physical barrier protection)"
 **30,0%**
- B. "Os riscos identificados na Avaliação de Risco (The risks identified in the Risk Assessment)"
 **43,3%**
- C. "Ambas as anteriores. (All of the above)"
 **26,7%**

Safety Systems

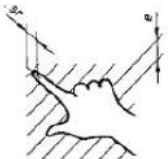
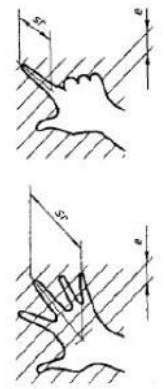
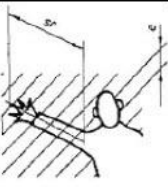
Risk Engineering



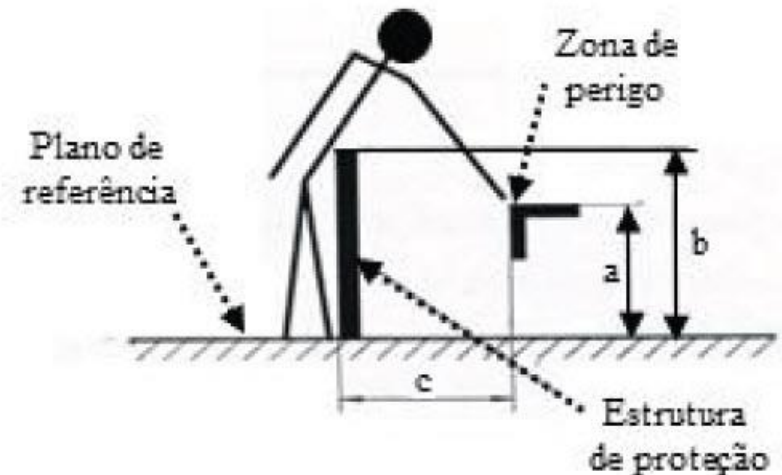
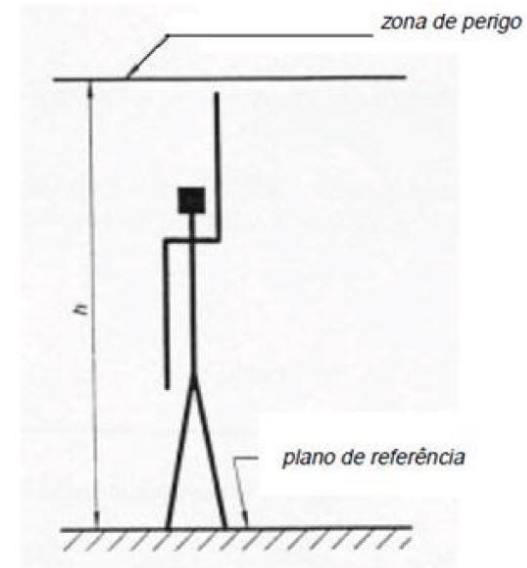
Source: OSHA /
Rodolfo Andrade Gouveia Vilela

Safety Systems

Risk Engineering

Parte do corpo	Ilustração	Abertura	Distância de segurança sr		
			fenda	quadrado	circular
Ponta do dedo		$e \leq 4$	≥ 2	≥ 2	≥ 2
		$4 < e \leq 6$	≥ 10	≥ 5	≥ 5
Dedo até articulação com a mão		$6 < e \leq 8$	≥ 20	≥ 15	≥ 5
		$8 < e \leq 10$	≥ 80	≥ 25	≥ 20
		$10 < e \leq 12$	≥ 100	≥ 80	≥ 80
		$12 < e \leq 20$	≥ 120	≥ 120	≥ 120
		$20 < e \leq 30$	$\geq 850^{1)}$	≥ 120	≥ 120
Braço até junção com o ombro		$30 < e \leq 40$	≥ 850	≥ 200	≥ 120
		$40 < e \leq 120$	≥ 850	≥ 850	≥ 850

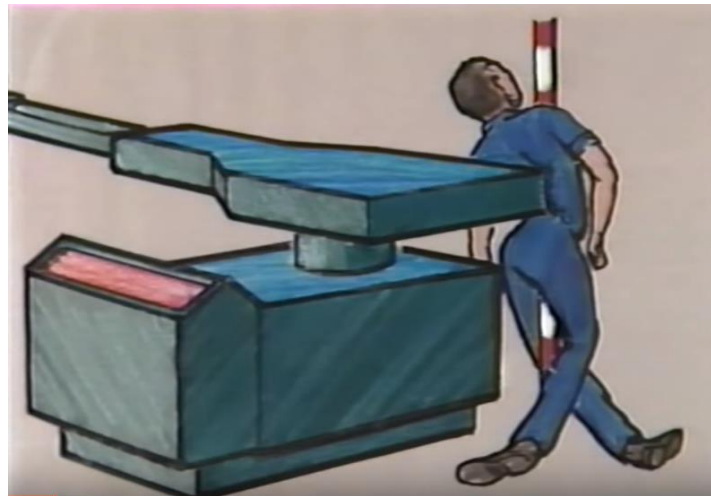
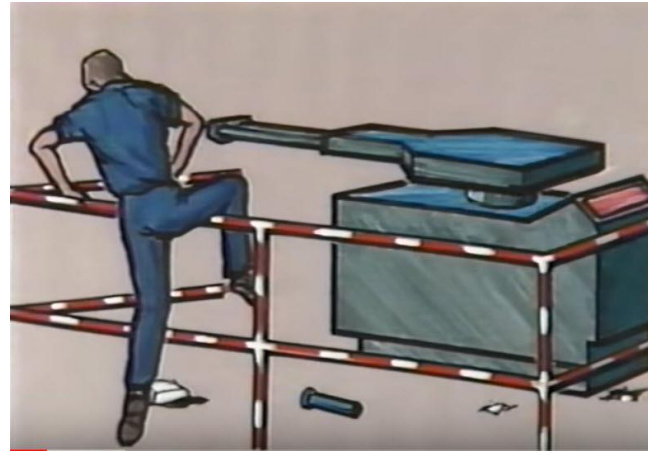
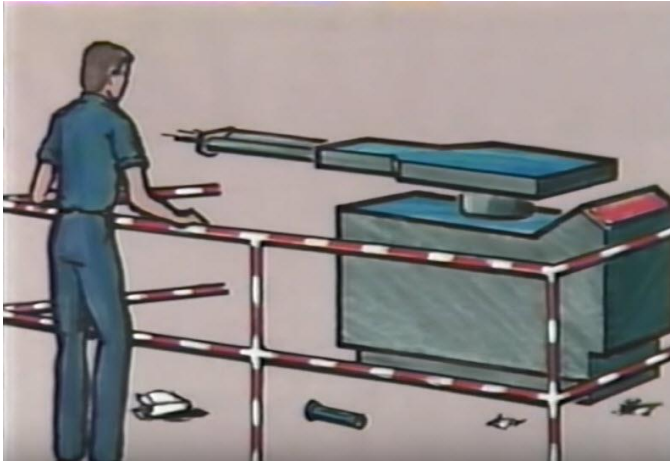
¹⁾ Se o comprimento da abertura em forma de fenda $e \leq 65$ mm, o polegar atuará como um limitador e a distância de segurança poderá ser reduzida para 200 mm.



Source: NR12 (Anexo I)

Safety Systems

Risk Engineering



Emergency Stop Devices

Risk Engineering

- Machines will be equipped with E-Stop
- Not to be used to start/stop normal ops
- Easy access
- Not to impair ops
- Interfere with rescue
- Generate other risks



Permanent Means of Access

Risk Engineering

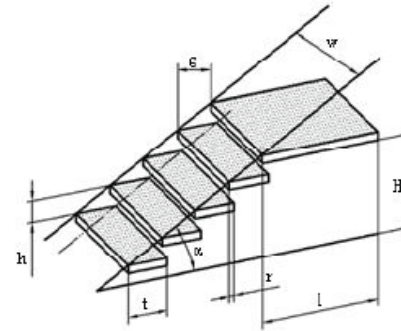
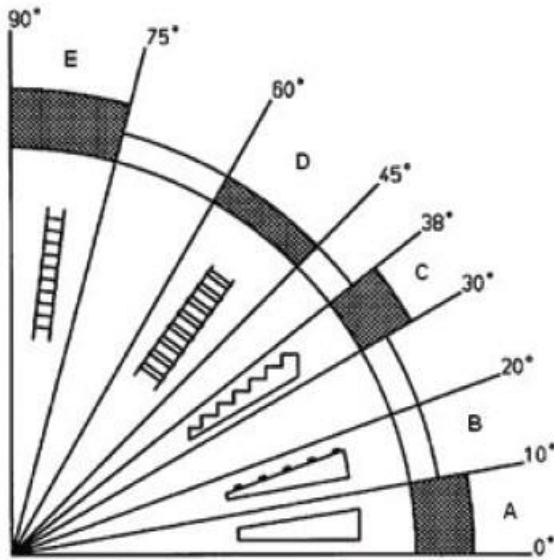
- Have access to equipment
- Includes:
 - Walkways
 - Ramps
 - Platforms
 - Stairs
 - Lifts



Permanent Means of Access

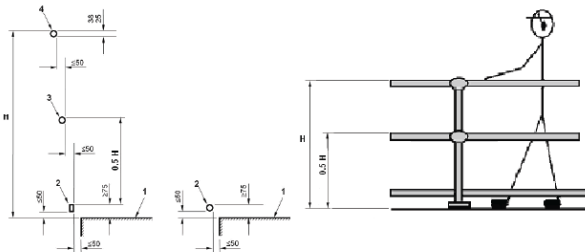
Risk Engineering

Figura 3: Exemplo de escada fixa do tipo marinheiro.



Legenda:

- w: largura da escada
- h: altura entre degraus
- r: projeção entre degraus
- g: profundidade livre do degrau
- α : inclinação da escada - ângulo de lance
- l: comprimento da plataforma de descans
- H: altura da escada
- t: profundidade total do degrau



Legenda:

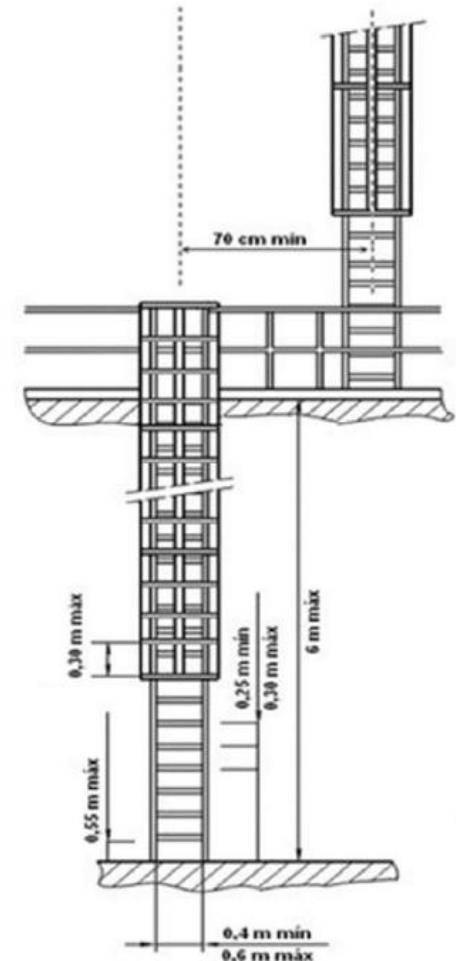
H: altura barra superior, entre 1000 mm (mil milímetros) e 1100 mm (mil e cem milímetros)

1: plataforma

2: barra-rodapé

3: barra intermediária

4: barra superior corrimão



Source: NR12 (Anexo III)

Summary – Take Aways

- NR-12 is only one of 36 NRs and it only addresses machine and equipment safety
- NR-12 is a very extensive regulation with 19 sections and 12 Annexes. Only touched seven
- NR-12 is a serious regulation dealing with life and death matters for your employees as seen through some of our examples and must be taken seriously.

Questões?

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Obrigado!

Zurich Risk Engineering

<https://www.zurich.com/en/products-and-services/protect-your-business/risk-engineering>



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