# SEP0279 – PORCESSAMENTO DE MATERIAIS II - USINAGEM DOS METAIS

## AULA-4: Geometria da Cunha Cortante

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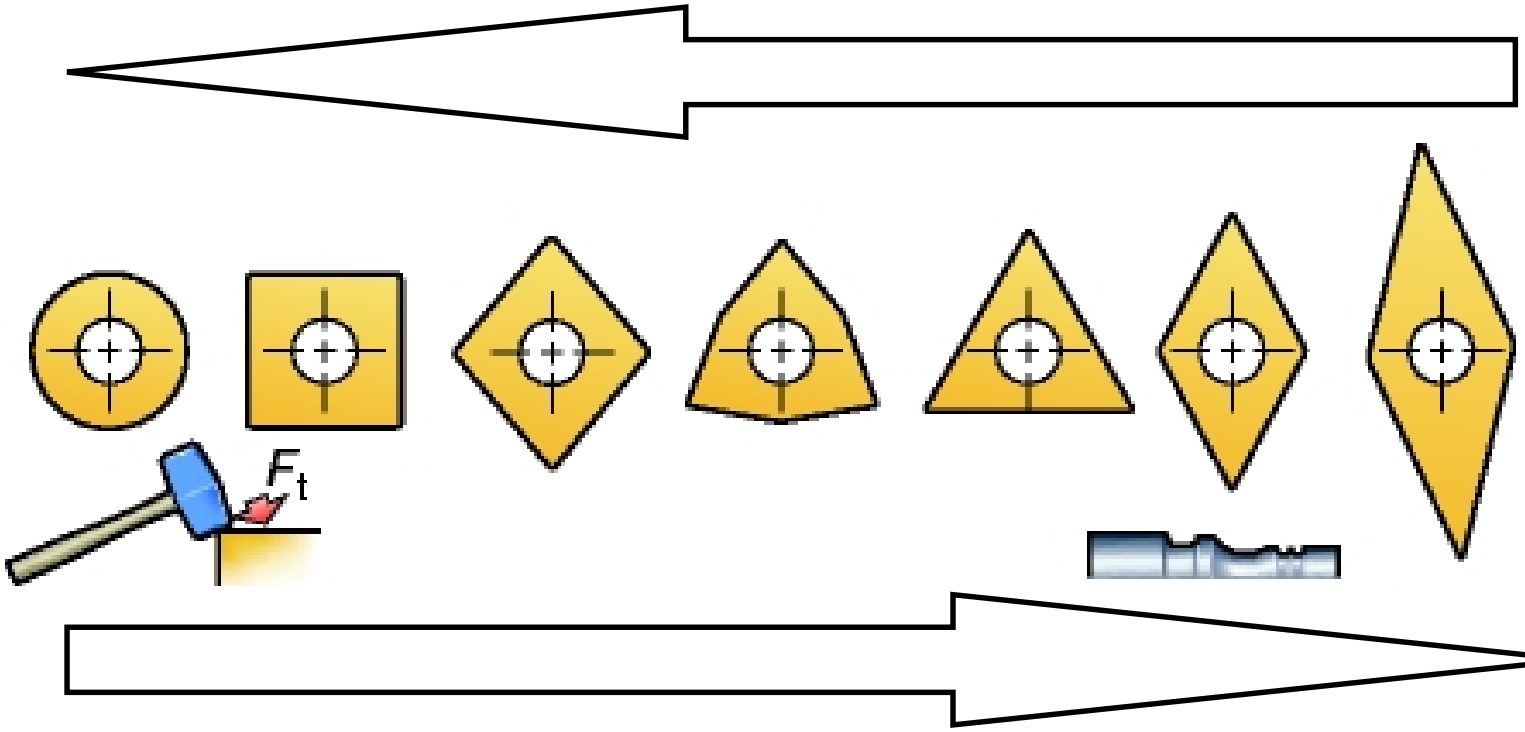
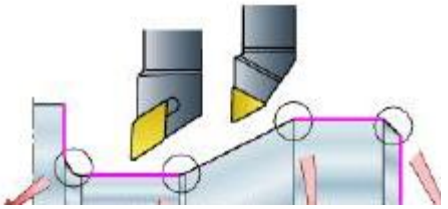
# GEOMETRIA DA CUNHA CORTANTE

## GEOMETRIA EXTERNA – Resistência mecânica

Aumento de resistência mecânica




Aumento de acessibilidade



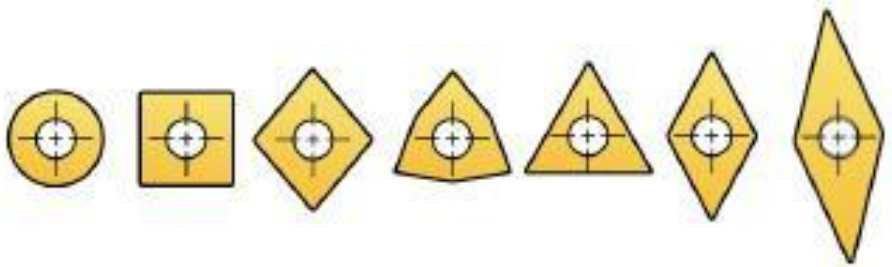
# GEOMETRIA DA CUNHA CORTANTE

**GEOMETRIA EXTERNA** **Aumento de produtividade**

# GEOMETRIA DA CUNHA CORTANTE

## GEOMETRIA EXTERNA

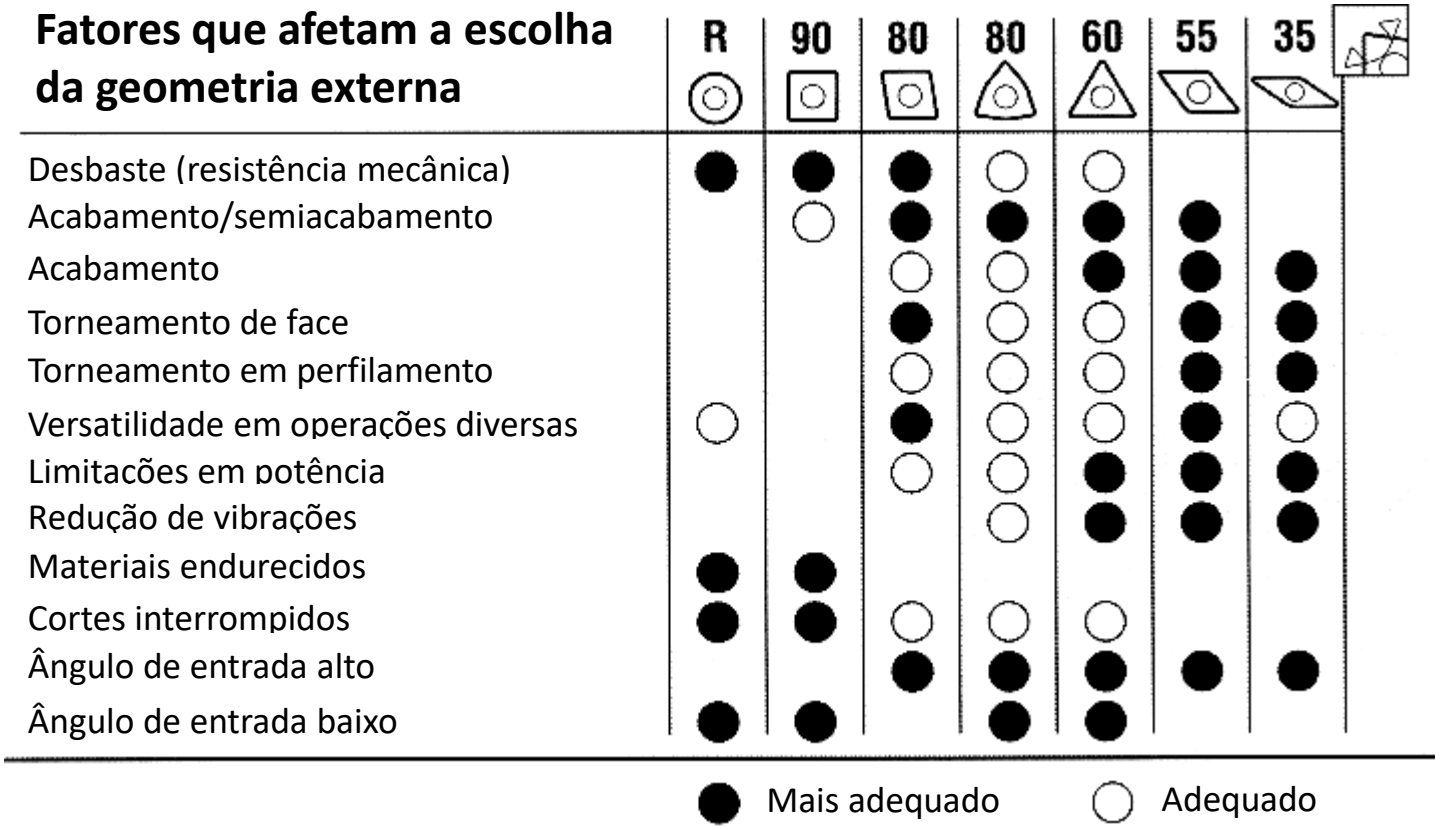
**Número de arestas utilizáveis**



| Forma básica | R | S | C | W | T | D | V |
|---|---|---|---|---|---|---|---|
| Duas faces | *) ∞ | 8 | 4 | 6 | 6 | 4 | 4 |
| Uma face | ∞ | 4 | 2 | 3 | 3 | 2 | - |
| Positivo | ∞ | 4 | 2 | 3 | 3 | 2 | 2 |

# GEOMETRIA DA CUNHA CORTANTE

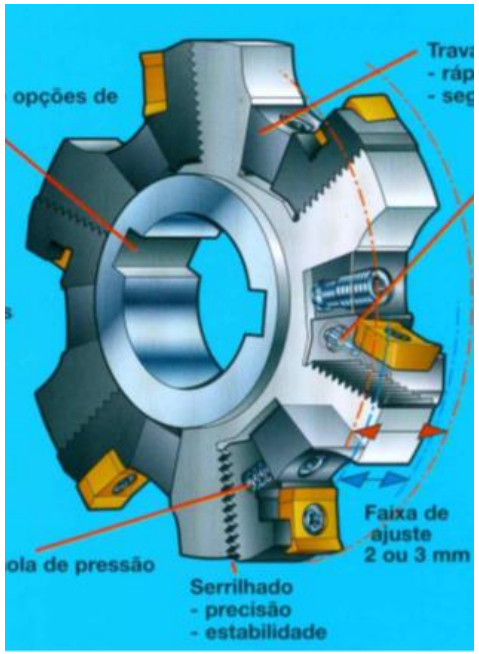
## GEOMETRIA EXTERNA - Aplicações

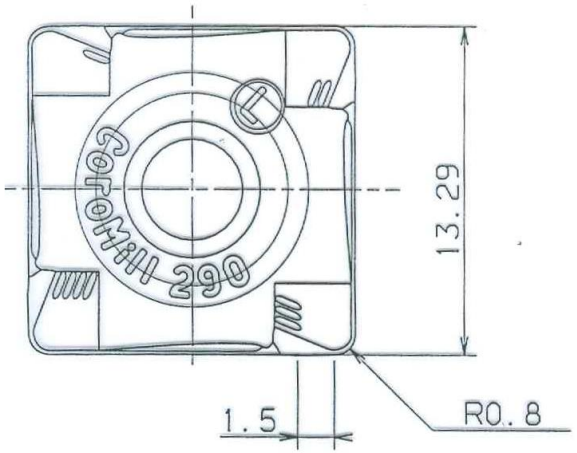


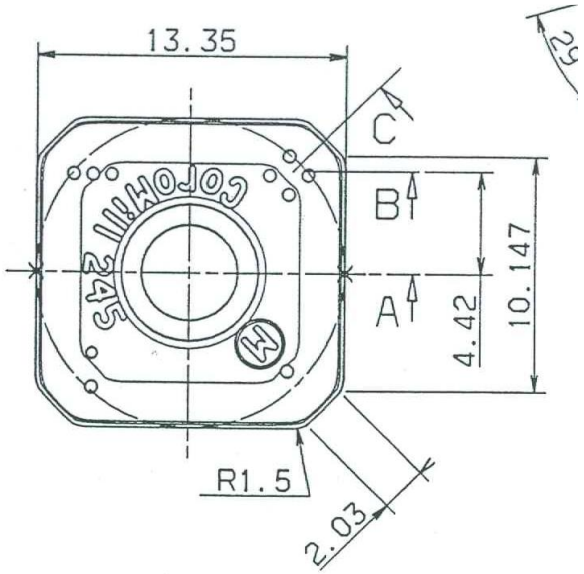
# GEOMETRIA DA CUNHA CORTANTE

## GEOMETRIA EXTERNA - exemplos



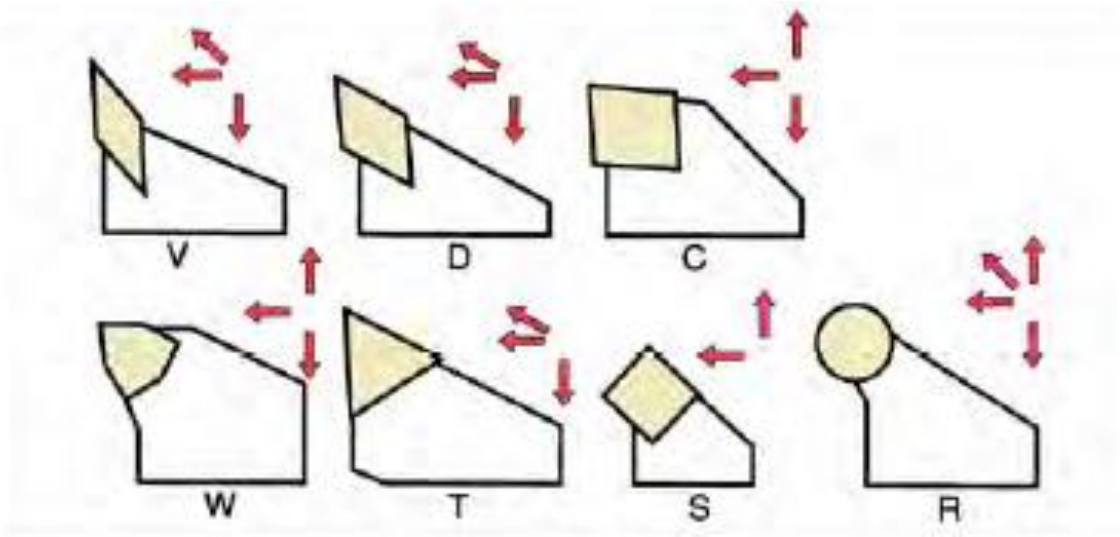



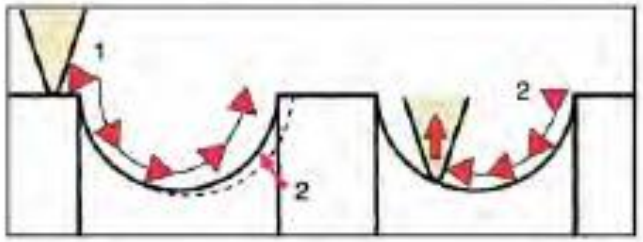



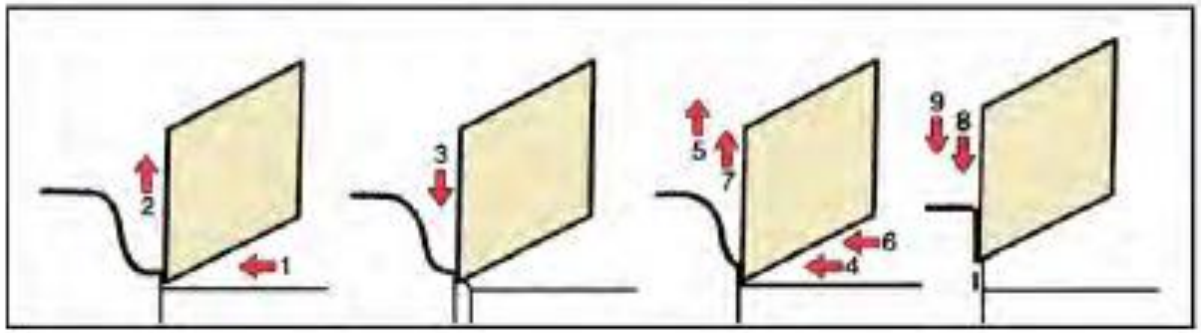



# GEOMETRIA DA CUNHA CORTANTE

## Acessibilidade - torneamento



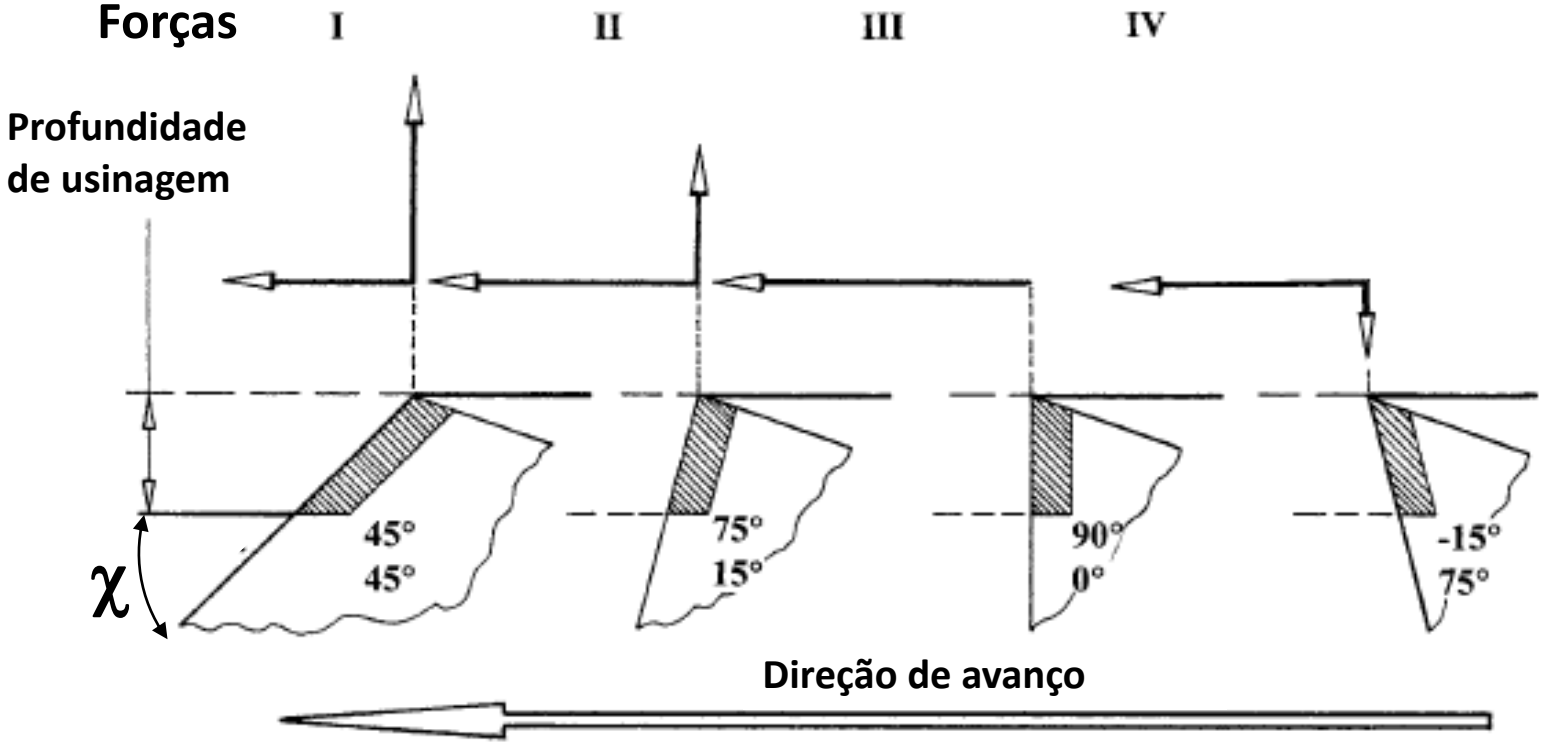



# GEOMETRIA DA CUNHA CORTANTE

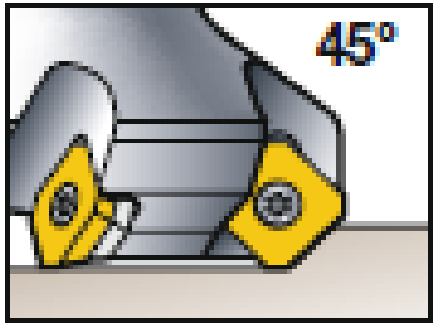
## Ângulo de Posição- Torneamento

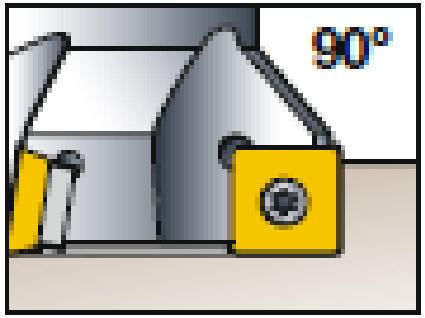
### Forças de reação

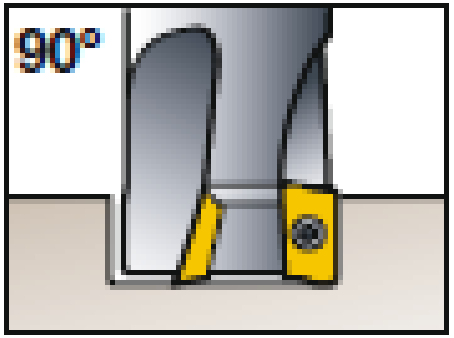


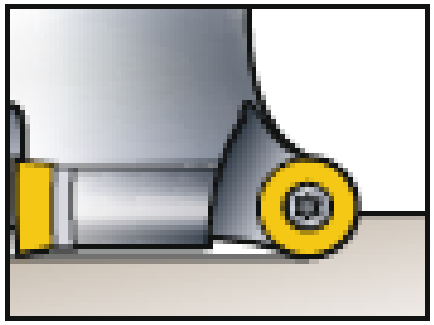
# GEOMETRIA DA CUNHA CORTANTE

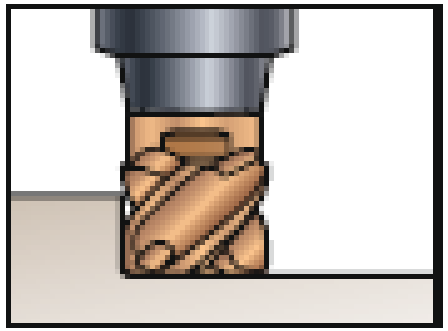
## Ângulo de Posição - Fresamento



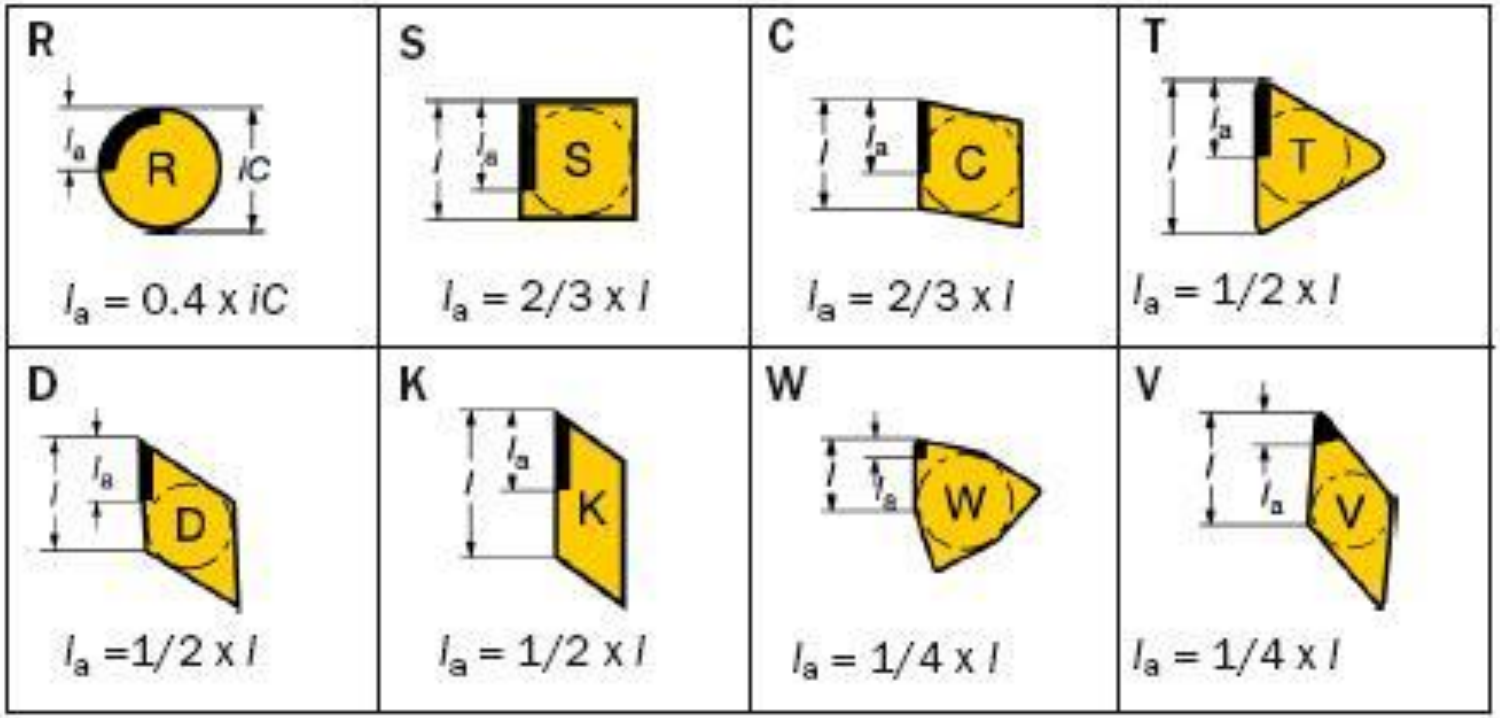





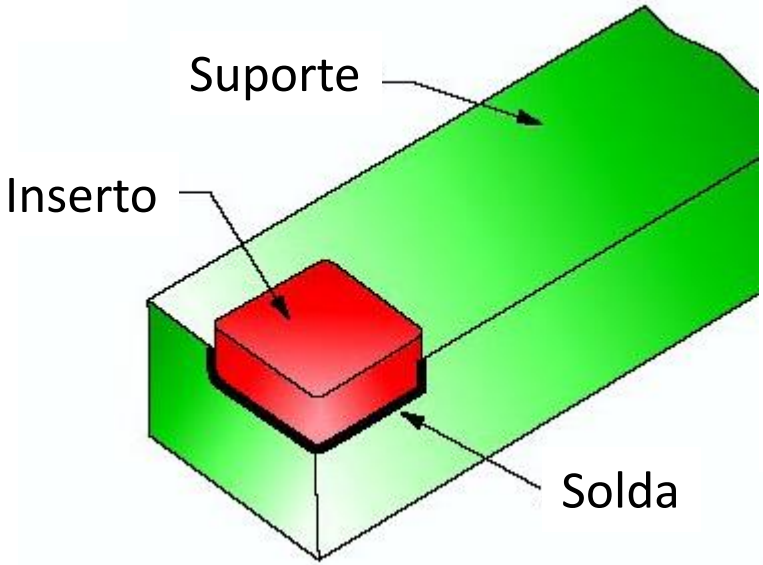
# GEOMETRIA DA CUNHA CORTANTE

**Máxima Profundidade de Usinagem**

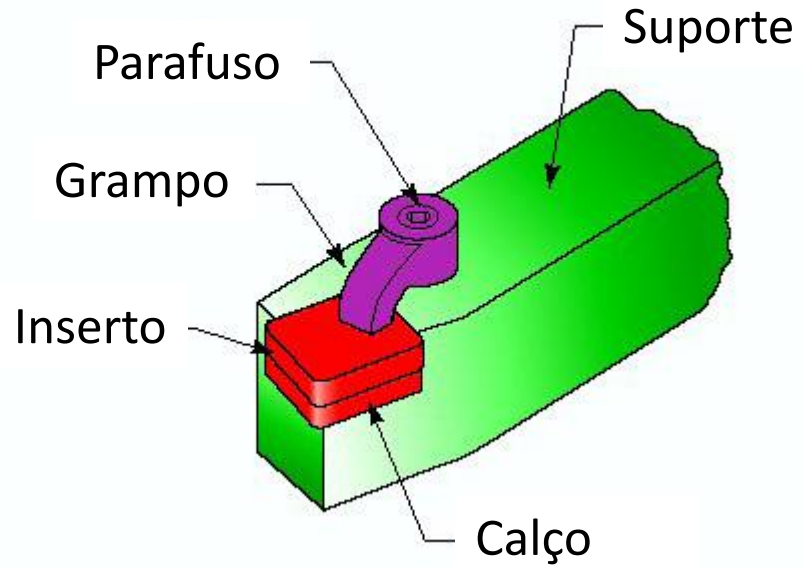


# GEOMETRIA DA CUNHA CORTANTE

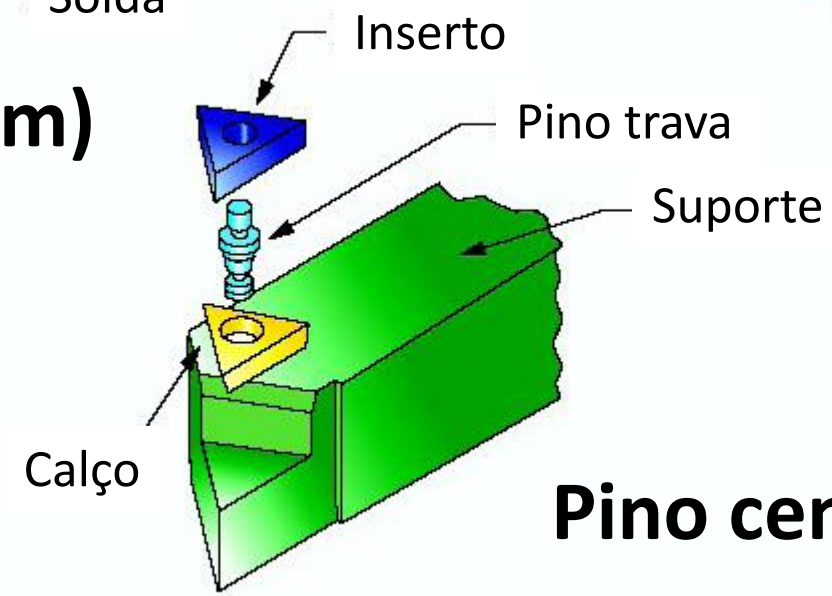
## Fixação dos insertos - Torneamento




**Solda (brasagem)**




**Grampo**

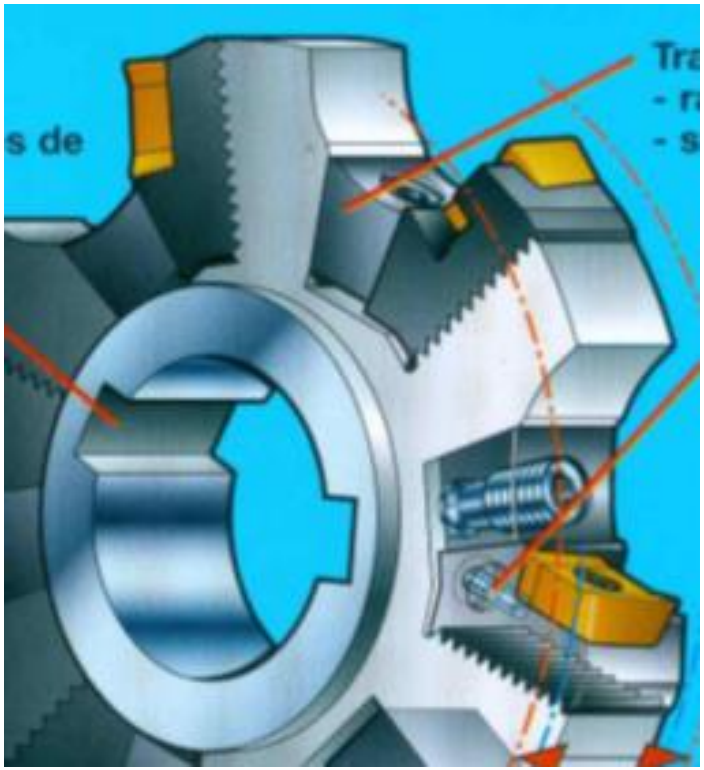



**Pino central**

# GEOMETRIA DA CUNHA CORTANTE

## Fixação dos insertos - Fresamento

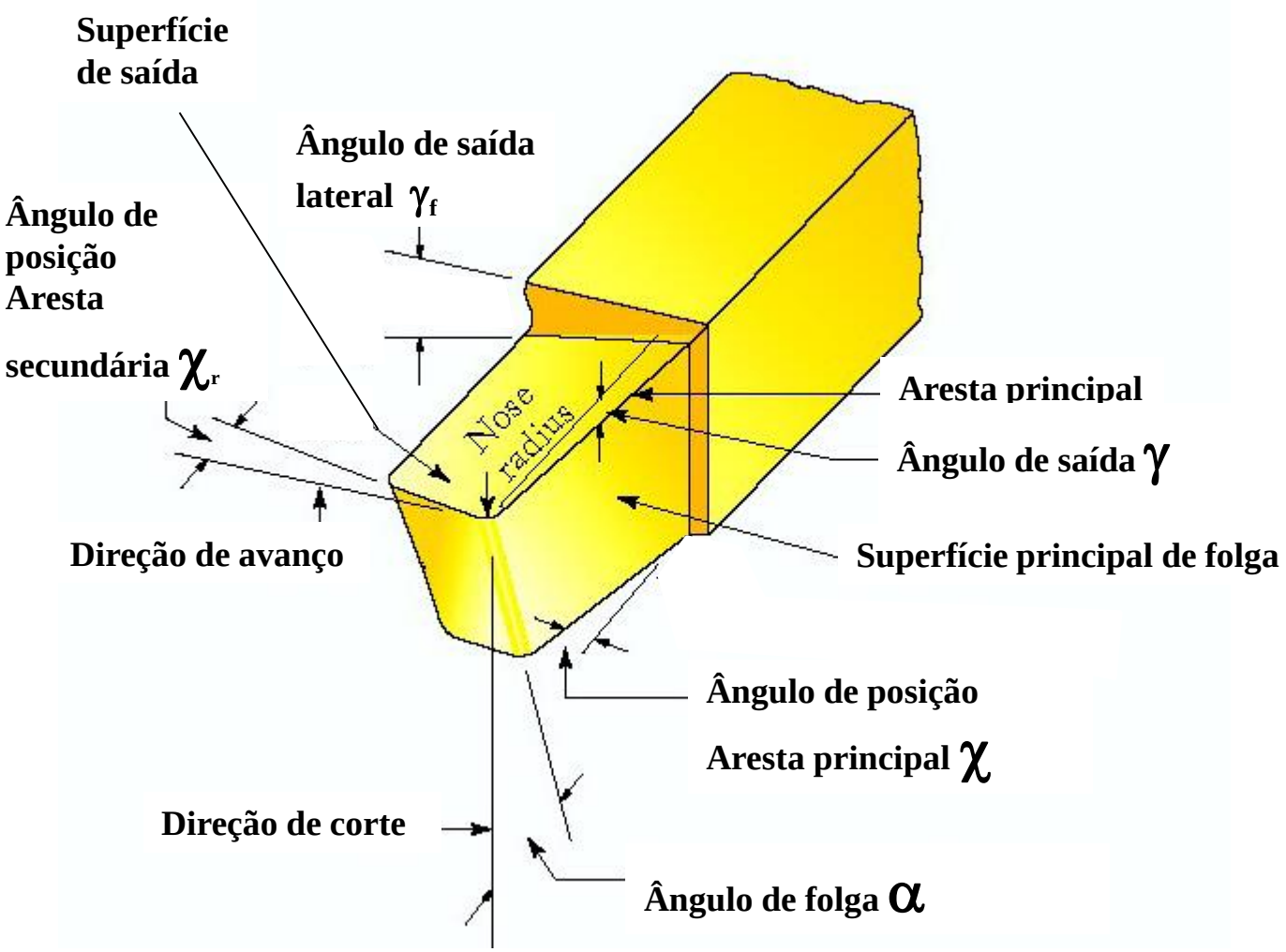

Parafuso central



Pino central + cunha

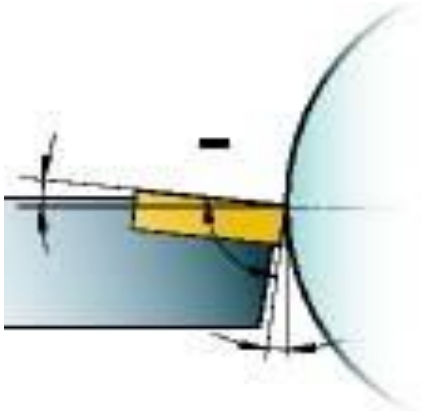
# GEOMETRIA DA CUNHA CORTANTE

## Ângulos e superficies de uma ferramenta

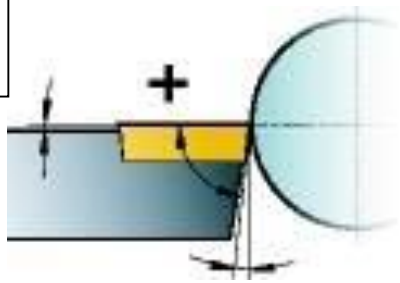


# GEOMETRIA DA CUNHA CORTANTE

## ÂNGULO DE SAÍDA - Torneamento



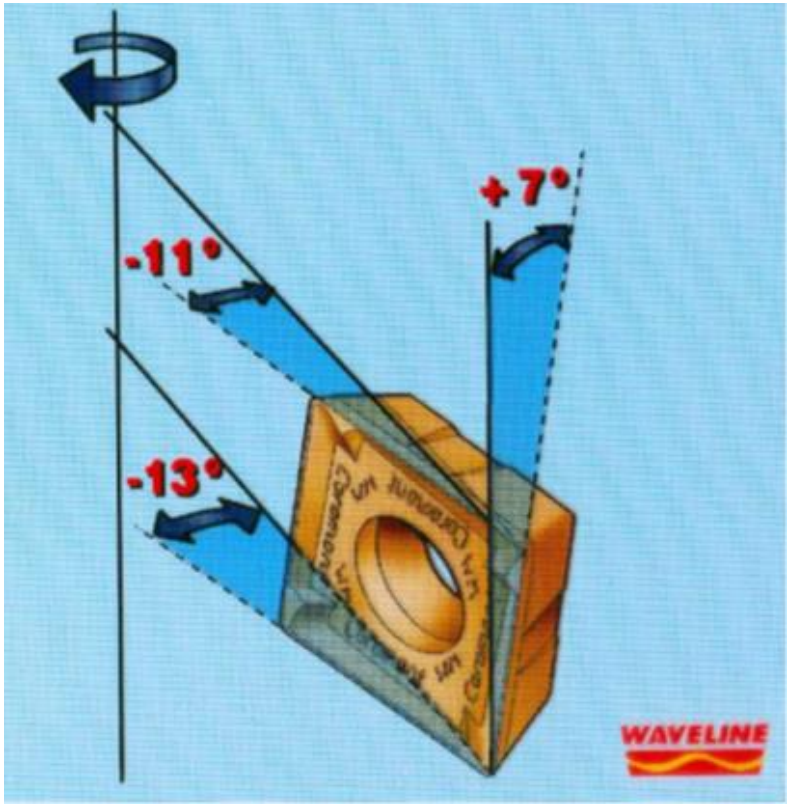

Insertos com dois lados
Alta resistência da cunha
Inserto sem ângulo de folga
Desbastes pesados



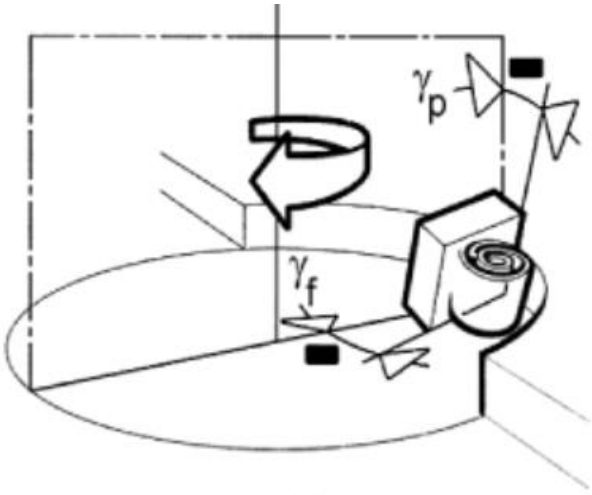

Insertos com um lado
Baixas forças e potência
Cortes de acabamento.

# GEOMETRIA DA CUNHA CORTANTE

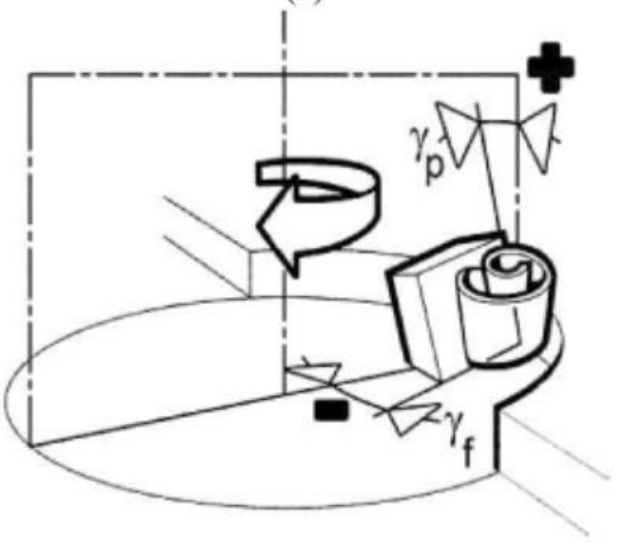
## ÂNGULO DE SAÍDA - Fresamento




**Fresamento:**
**Ângulo de saída radial**
**Ângulo de saída axial**



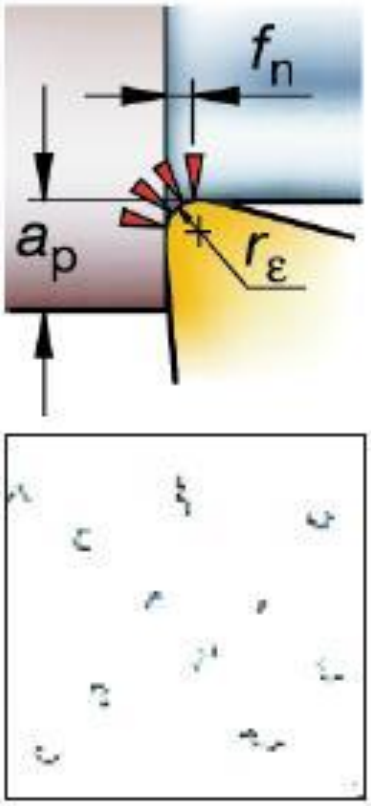

(a)



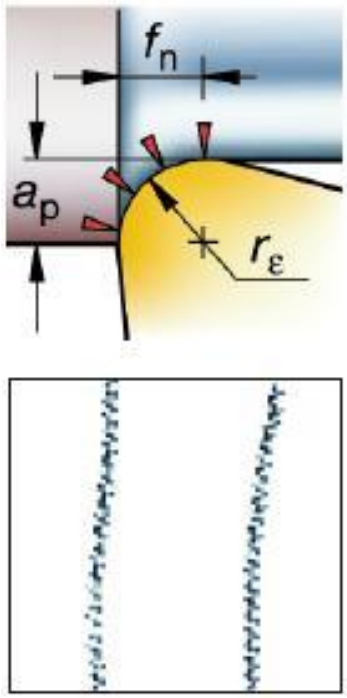

(b)

# GEOMETRIA DA CUNHA CORTANTE

**Raio de ponta - Torneamento**




- Pequenas profundidades
- Reduz vibrações
- Insertos com menor resistência




- Grandes profundidades
- Grandes avanços
- Arestas robustas
- Aumenta forças radiais

# GEOMETRIA DA CUNHA CORTANTE

## Raio de ponta

Insertos negativos

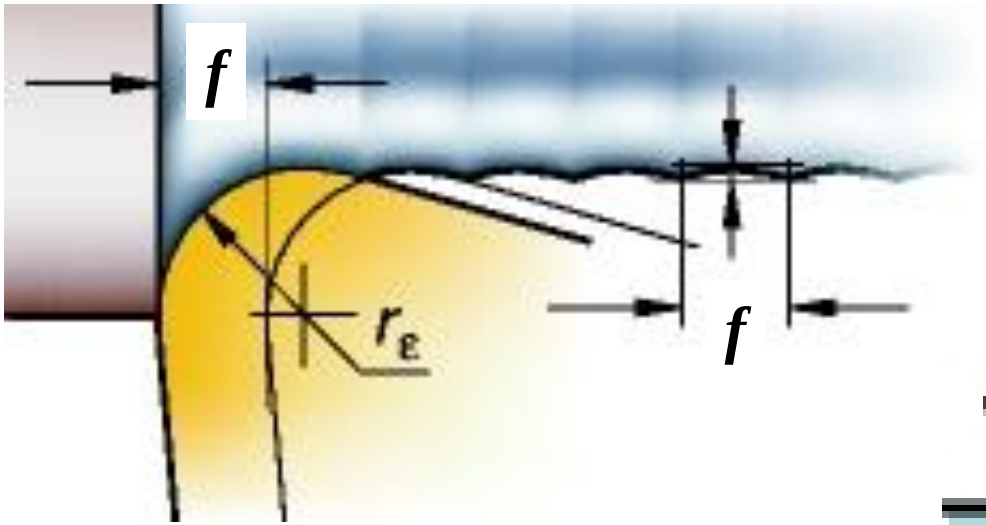
| Raio de ponta, mm | 0.4 | 0.8 | 1.2 | 1.6 | 2.4 |
|---|---|---|---|---|---|
| Max. recomendado mm/rev | | | | | |
| Acabamento | 0.25 | 0.4 | 0.5 | 0.7 | |
| Médio | 0.3 | 0.5 | 0.6 | 0.8 | (1.0) |
| Desbaste | 0.3 | 0.6 | 0.8 | 1.0 | 1.5 |

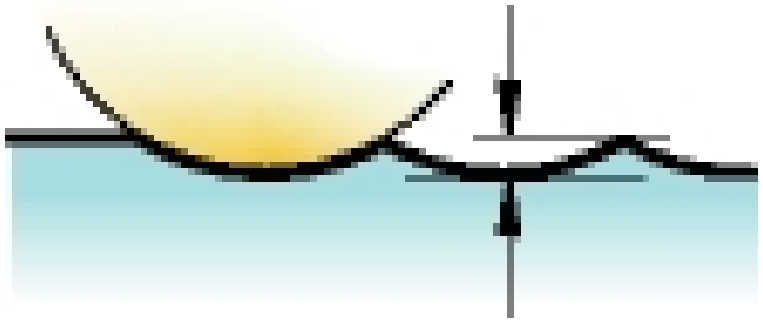
Insertos positivos

| Raio de ponta, mm | 0.2 | 0.4 | 0.8 | 1.2 |
|---|---|---|---|---|
| Max. recomendado mm/rev | | | | |
| Acabamento | 0.10 | 0.2 | 0.3 | 0.4 |
| Médio | 0.15 | 0.3 | 0.4 | 0.5 |

# GEOMETRIA DA CUNHA CORTANTE

**Raio de ponta e rugosidade**

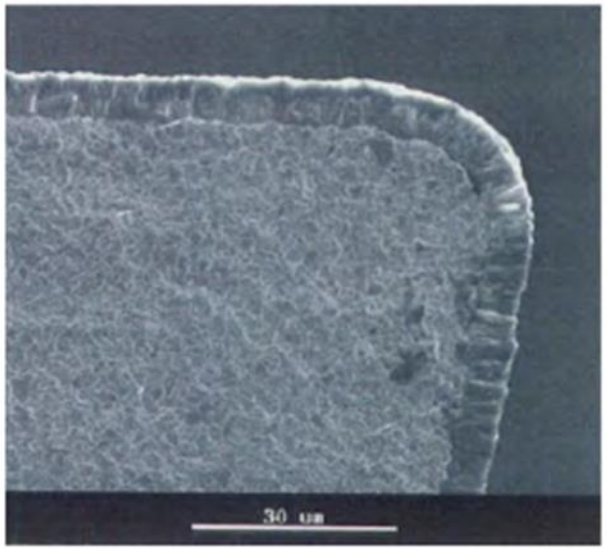


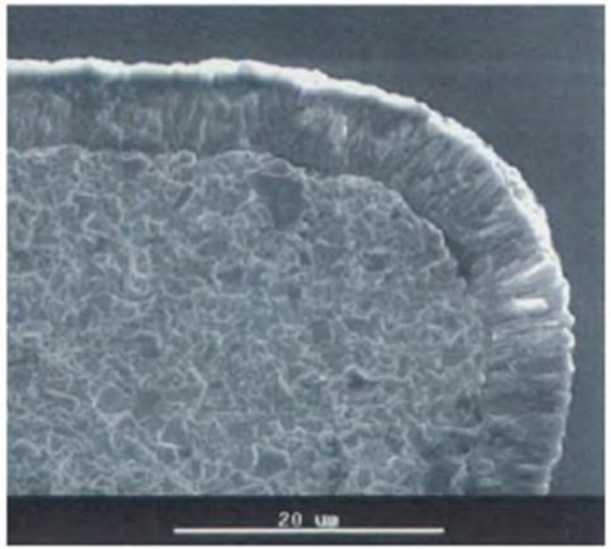



$$R_{max} = \frac{f_n^2}{8 \times r_\varepsilon} \times 1000$$

# GEOMETRIA DA CUNHA CORTANTE

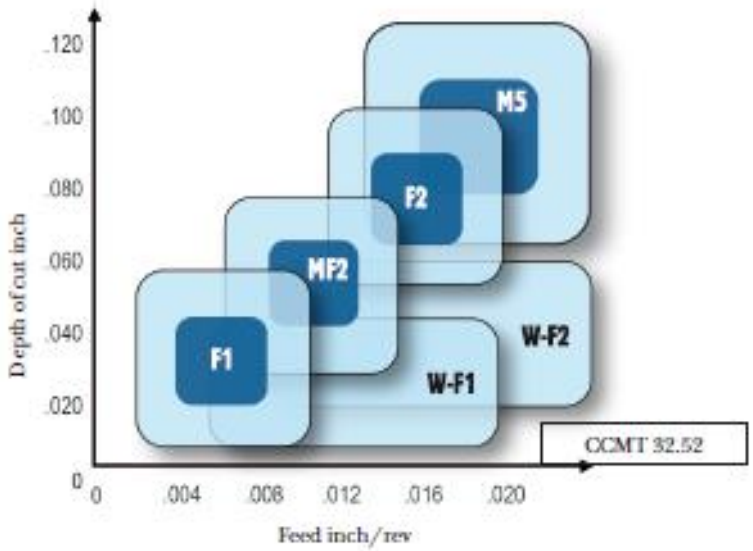
**Quebra-cavacos e coberturas**

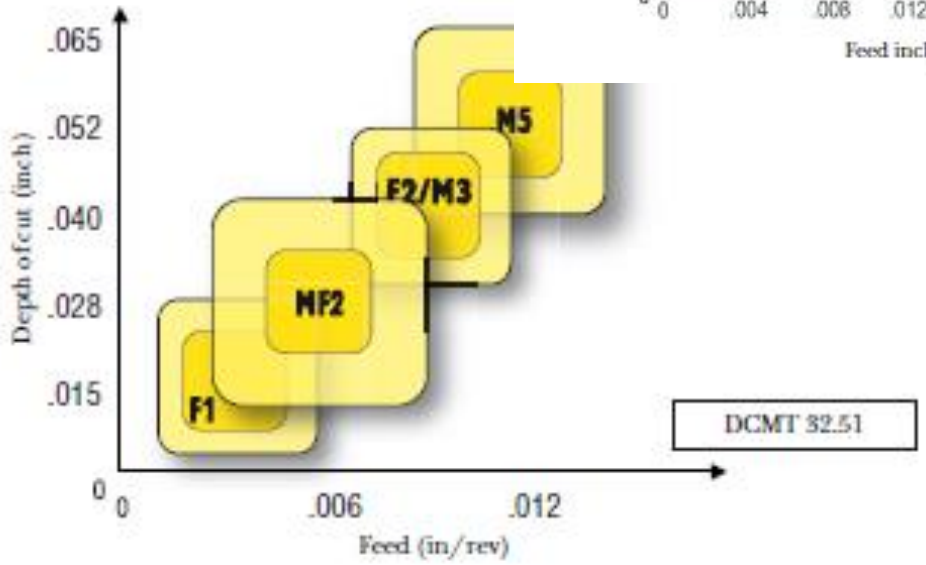



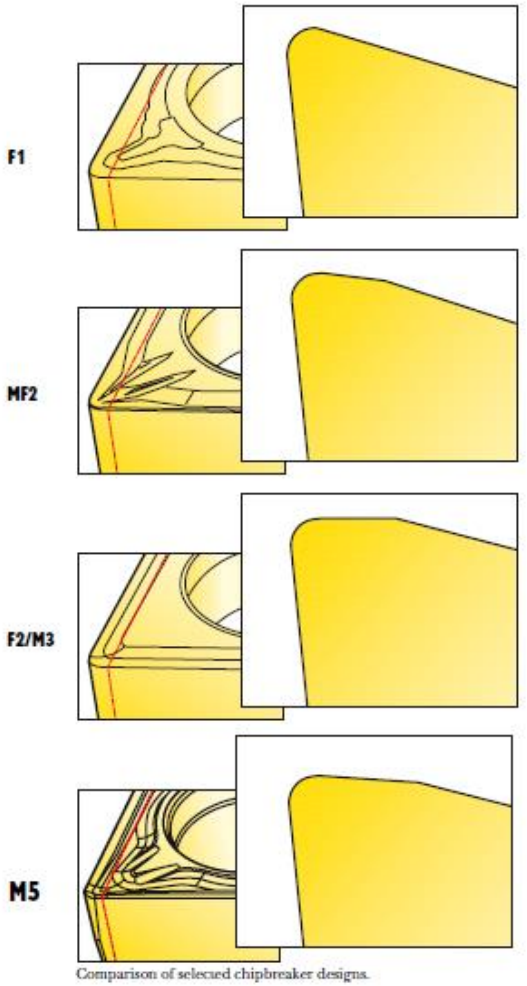



# GEOMETRIA DA CUNHA CORTANTE

## Quebra-cavacos - Exemplos



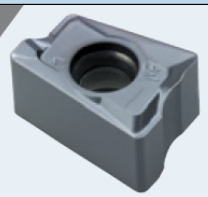
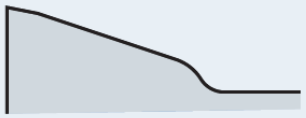




Comparison of selected chipbreaker designs.

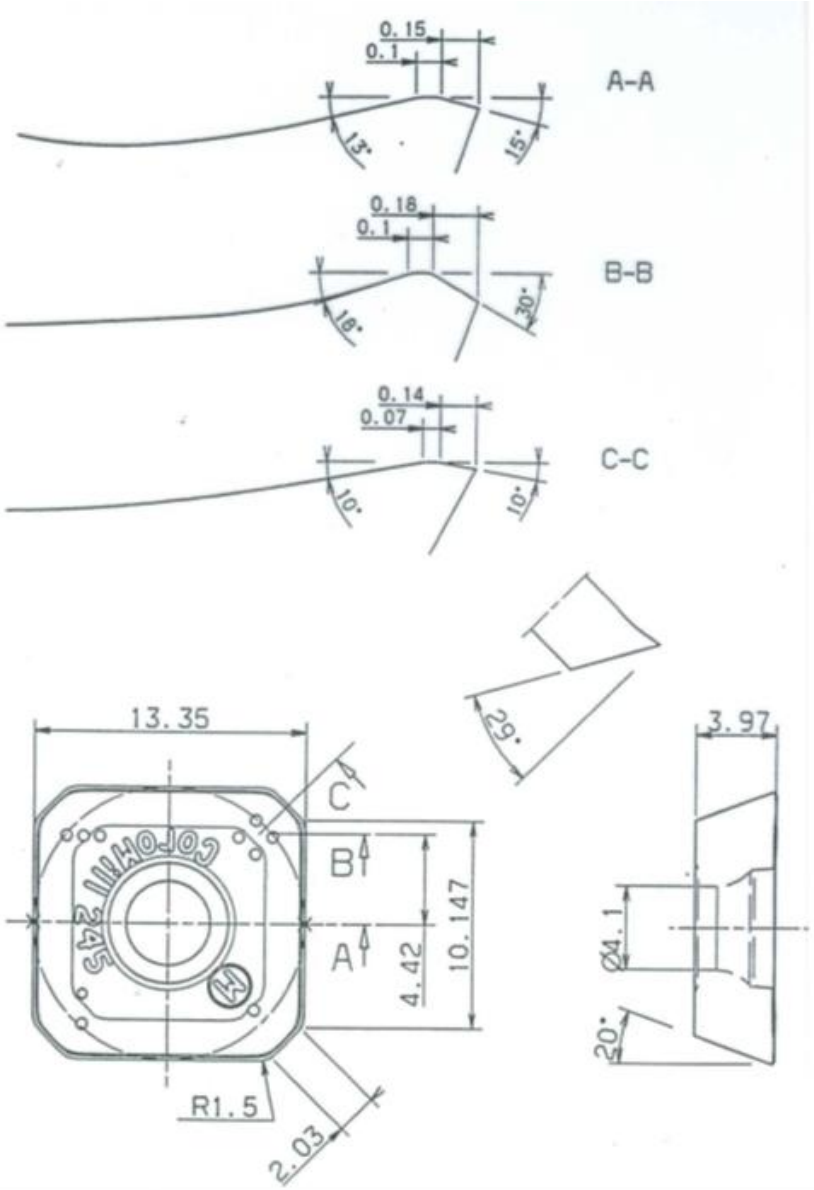
# GEOMETRIA DA CUNHA CORTANTE

## Quebra-cavacos - Exemplos

| Geometry | Cutting edge | Application range<br>feed rate (mm/t): 0.04 0.063 0.10 0.16 0.25 0.4 0.63 1.0 1.6 2.5 4.0 6.3<br>depth of cut (mm): 0.1 0.16 0.25 0.4 0.63 1.0 1.6 2.5 4.0 6.3 10.0 11.6 13 |
|---|---|---|
| MF  |  | 0.05~0.3<br>1.0~14.0 |
| MM  |  | 0.05~0.3<br>0.5~14.0 |
| MF  |  | 0.05~0.2<br>0.5~5.0 |
| MM  |  | 0.05~0.3<br>0.5~8.0 |

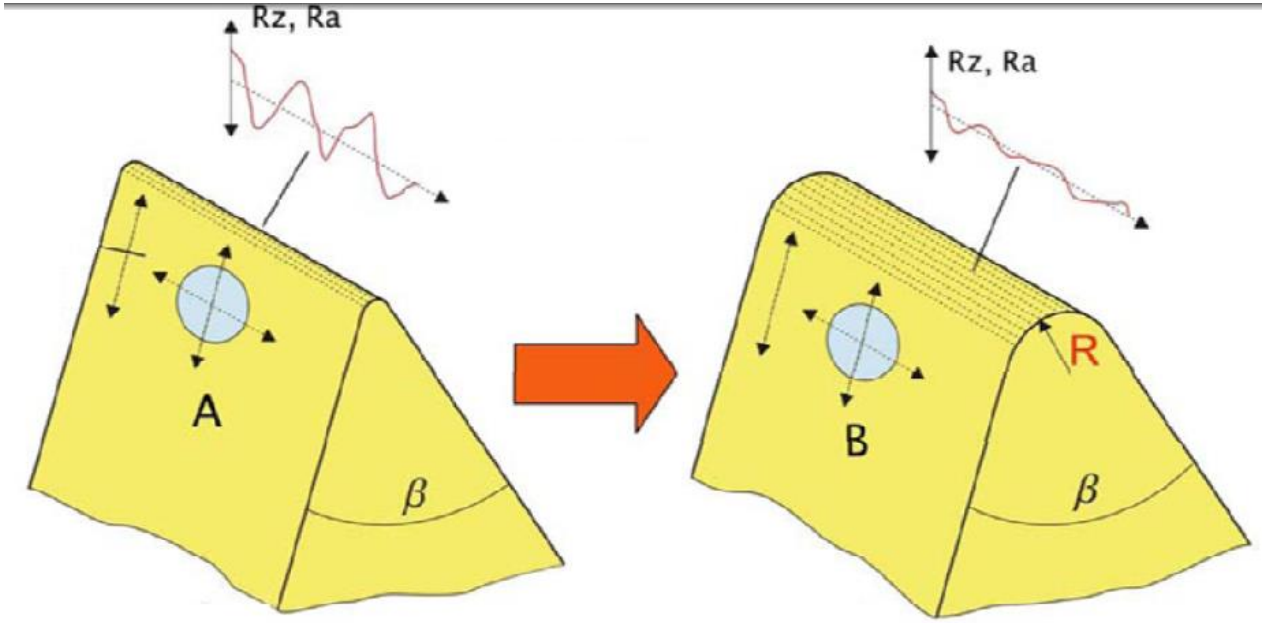
# GEOMETRIA DA CUNHA CORTANTE

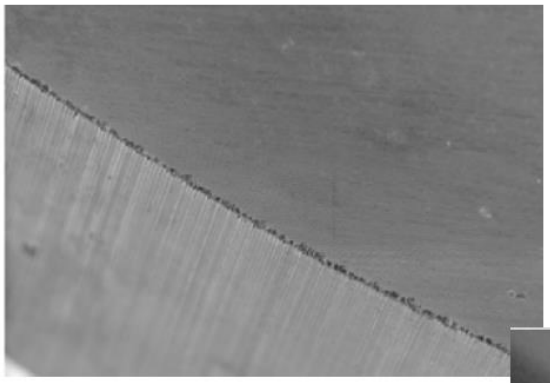
**Quebra-cavacos - Exemplos**

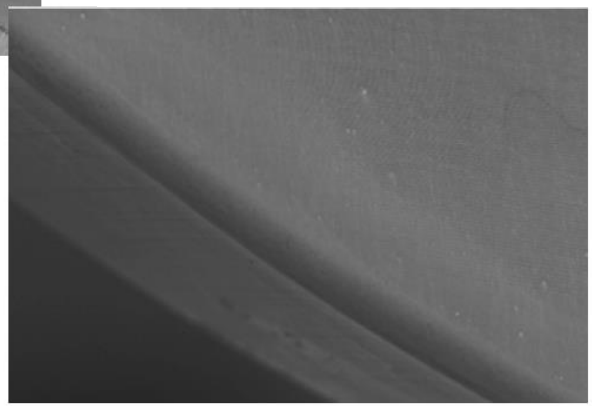


# GEOMETRIA DA CUNHA CORTANTE

## Raio/chanfro de aresta

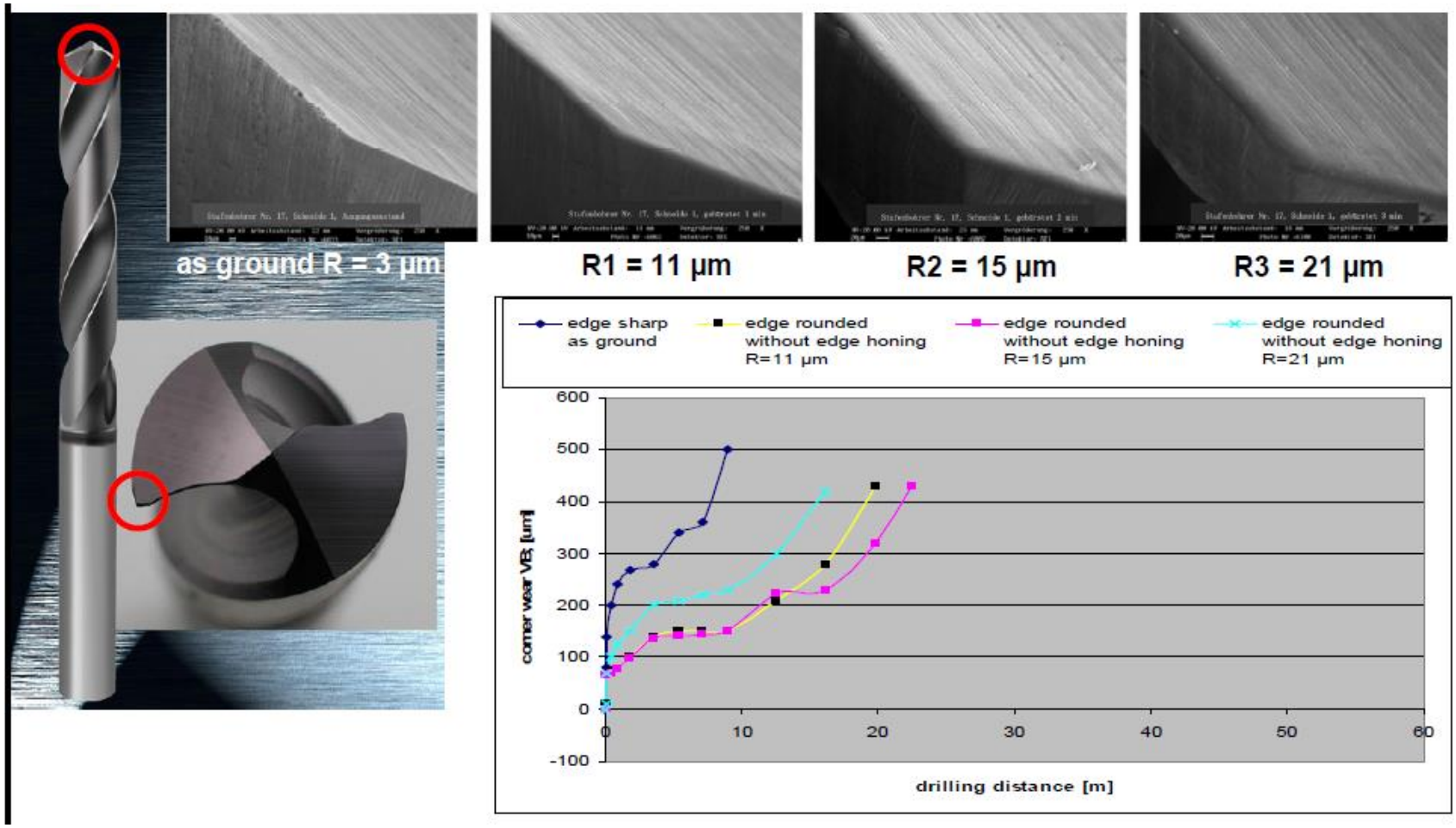




# GEOMETRIA DA CUNHA CORTANTE

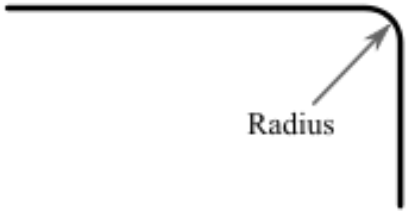
## Raio/chanfro de aresta



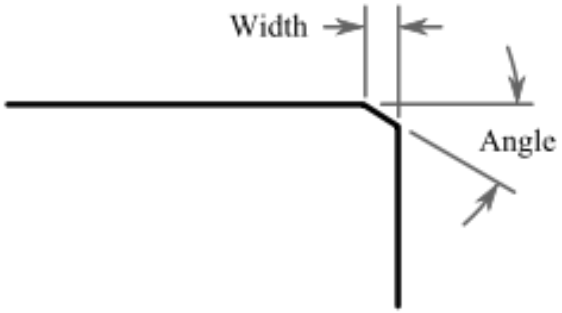
# GEOMETRIA DA CUNHA CORTANTE

## Raio/chanfro de aresta

| Operation | Rake angle | Chamfer |
|---|---|---|
| General purpose | Negative | 0.20 mm × 20° (0.008 in. × 20°) |
| Finishing | Negative or positive | 0.075 mm × 25° (0.003 in. × 25°) |
| General purpose and milling | Negative | 0.15 mm × 30° (0.006 in. × 30°) |
| Heavy roughing | Negative | 0.38 mm × 25° (0.015 in. × 25°) |
| Special | Negative or positive | Special |




Special applications, fine finishing




General-purpose grades,
higher forces, negative rake angles