YOUR ESSENTRA ESSENTIAL GUIDE

A materials guide to cap and plug selection:

HYDRAULIC AND PNEUMATIC **APPLICATIONS**

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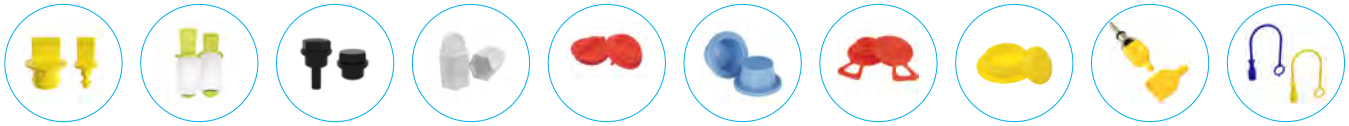

CAPS AND PLUGS
DRIVE VALUE

Selecting the correct materials for the job.

CAPS AND PLUGS PERFORM MANY VITAL ROLES THROUGHOUT THE LIFECYCLES OF KEY COMPONENTS AND ASSEMBLIES:

- Safeguard Connections
- Resist damage
- Mask key areas
- Prevent contamination
- Expedite handling
- Absorb residual fluids

Each role can prevent costly rework, facilitate smooth assembly, and keep systems running effectively – delivering considerable value.

Selecting the correct material is vital. Each has its own set of properties which determine how effectively your plug or cap will perform. Various factors affect this choice and should be reviewed extensively.

Essentra's extensive range of caps and plugs can meet the needs of any application.

This guide will help you through the material selection process.

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HYDRAULIC & PNEUMATIC **APPLICATIONS**

Sensitive systems need precise solutions.

HYDRAULIC AND PNEUMATIC SYSTEMS ARE ACUTELY SENSITIVE.

Tight seals, high pressures, precise assemblies, and strict standards – each demands that components remain in peak condition.

When connections fail or systems are contaminated, the downstream effects are not only costly but dangerous.

Hydraulic and pneumatic systems rely heavily on the correct use of caps and plugs throughout their lifecycle.

The proper selection of materials is critical to protect these highly sensitive machined parts.

Material selection is as important as using caps and plugs in the first place. There are no half-measures or shortcuts.

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WHY MATERIAL CHOICE **MATTERS**

SEVERAL FACTORS AFFECT MATERIAL CHOICE.

APPLICATION

ENVIRONMENT

PRODUCTION PROCESS

SUSTAINABILITY

ERGONOMICS

Caps and plugs can be made from a variety of materials, each with its own set of physical properties.

Your material selection process should be guided by matching these properties with your application's needs.

The wrong material choice can compromise clean systems, lead to misshapen parts or damaged threads, or cause assembly and treatment processes to fail.

However, with due process, the ideal solution can be found for almost any application.

MATCHING PROPERTIES WITH PURPOSE.

MATERIAL
CONSIDERATIONS

WHEN SELECTING A MATERIAL FOR CAPS AND PLUGS APPLICATIONS, THERE ARE SEVERAL KEY CONSIDERATIONS.

A helpful starting point is understanding the value of the product or assembly being protected and the potential cost of failure downstream.

Each material has its own strengths and limitations. Selecting the optimal option often involves balancing physical properties, ease of assembly, and cost.

With the right evaluation, almost any application can be matched with a suitable solution.

If you are unsure about any of the following material considerations, Essentra support teams are ready to help guide you through the selection process.

Free samples are available.

EVALUATION QUESTIONS

Sustainability	Do you require recycled materials? Will the caps and plugs be recycled after use? Will they be used multiple times?
Temperature (high and low)	What temperature ranges will they be exposed to? Is it direct or indirect heat? Will temperatures rapidly change? Does the application involve masking?
Chemical resistance	What chemicals will they be exposed to? Are they solvents or corrosive? How long will any resistance be required for?
Moisture and weather	Do you require UV/wind/temperature-swing resistance? Do you need to absorb residual fluids? Will they be exposed to fluid mist, immersion, or full submersion?
Sealant potential	Are you creating a seal? How and at what stage will the seal be removed?
Tensile strength, impacts, and rigidity	Could impact or usage potentially deform their shape? Will these be one-time or multiple uses?
Shearing and torque	Do they need to resist any potential material shearing (i.e. pieces coming off) – common in thread and other rotative applications?
Pressure tolerance (+/-)	What +/- pressure tolerance is required (PSI/bar)? For how long will they be under pressure?
Application and removal	Will installation/removal be manual or automated? Will it be tool-assisted? Is colour coding required? Would an ergonomically designed product be helpful?

MATERIALS MATRIX: **OVERVIEW**

The following matrix sets the most common cap and plug material choices against their physical properties, providing an easy-to-use overview.

	Chemical Resistance	Moisture & Weather	Temperature Range	Shearing Resistance	Oil & Grease
Low-Density Polyethylene (LDPE)	Excellent	Poor UV	79.4˚C/175˚F -50°C	Fair	Moderate
High-Density Polyethylene (HDPE)	Excellent	Poor UV	~80–120°C	Good	Moderate
Polypropylene (PP)	Very good	Poor UV	~100–130°C	Good	Moderate
Thermoplastic Elastomer (TPE)	Excellent	Excellent	95°C/203°F -30°C/-22°F	Poor	Excellent
Thermoplastic Rubber (TPR)	Excellent	Excellent	95°C/203°F -30°C/-22°F	Poor	Good
Vinyl/PVC	Very good	Good	176.7˚C/350°F	Moderate	Good
High temperature Vinyl/PVC	Very good	Good	218°C/425°F	Moderate	Good
Nylon/PA	Poor	Good UV	149°C/300°F	Excellent	Excellent
Silicone	Excellent	Excellent when modified	315°C/600˚F -50°C/ -58˚F	Poor	Poor
Ethylene Propylene Diene Monomer (EPDM)	Excellent	Excellent	177°C/350°F -50°C/ -58˚F	Fair	Poor

MATERIALS MATRIX:
CHEMICAL RESISTANCE

The following matrix sets the most common cap and plug material choices against their physical properties, providing an easy-to-use overview.

	Sunlight	Weak Acids	Strong Acids	Weak Alkalis	Strong Alkalis	Organic Solvents
Low-Density Polyethylene (LDPE)	Crazes rapidly	Resistant	Attacked by oxidizing acids	Resistant	Resistant	Resistant Below (140°F/60°C)
High-Density Polyethylene (HDPE)	Crazes rapidly	Very resistant	Attacked by oxidizing acids	Very resistant	Very resistant	Resistant Below (176°F/80°C)
Polypropylene (PP)	Crazes rapidly	None	Attacked by oxidizing acids	None	Very resistant	Resistant Below (176°F/80°C)
Thermoplastic Elastomer (TPE)	Good resistance	Very resistant	Attacked	Very resistant	Resistant	Poor
Thermoplastic Rubber (TPR)	Crazes	Very resistant	Attacked by oxidizing acids	Very resistant	Very resistant	Resists most
Vinyl/PVC	Good resistance	Very resistant	Resistant	Very resistant	Resistant	Resistant to alcohols, aliphatic hydrocarbons and oils
High temperature Vinyl/PVC	Good resistance	Very resistant	Resistant	Very resistant	Resistant	Resistant to alcohols, aliphatic hydrocarbons and oils
Nylon/PA	Discolors	Discolors	Attacked	None	None	Resists most
Silicone	Very resistant	Poor	Poor	Poor	Poor	Poor
Ethylene Propylene Diene Monomer (EPDM)	Very resistant	Good resistance	Very resistant	Very resistant	Very resistant	Resistant

APPLICATION GUIDE
THREAD PROTECTION

Protecting threads from damage during assembly, storage, transport, or maintenance.

Deciding factors	Material properties
Sharp threads	Must resist shearing
Shock resistance	Must resist impacts and deformation
Contamination	Must prevent particle and dust ingress

Additional considerations	Material properties
Fluid or gas containment	Must prevent leakages and form a tight seal
Pressure tolerance	Must withstand low pressures
Chemical exposure	Must have appropriate chemical resistance

Entry level
LDPE

- Contamination and dust prevention
- Low impact resistance
- Good chemical resistance

Requires gasket or O-ring for seal

Mid-tier
TPE

- Contamination and dust prevention
- Shearing resistance
- Impact resistance
- Excellent chemical resistance

Requires gasket or O-ring for seal

Premium
Nylon

- Contamination and dust prevention
- Good shearing resistance
- High impact resistance and tensile strength
- Some chemical resistance
- Pressure resistance

Requires gasket or O-ring for seal

All material suggestions are for illustrative purposes only.
Contact Essentra for specific recommendations

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APPLICATION GUIDE
CONTAMINATION PREVENTION

Preventing particle ingress during assembly, storage, transport, or maintenance.

Deciding factors	Material properties
Contamination	Must prevent particle and dust ingress
Temperature/environment	Must have appropriate temperature tolerance

Additional considerations	Material properties
Fluid or gas containment	Must prevent particle and dust ingress
Pressure tolerance	Must have appropriate pressure rate resistance
Chemical exposure	Must have appropriate chemical resistance

Entry level
LDPE

- Contamination and dust prevention
- Suitable for ambient environments
- Low impact resistance
- Good chemical resistance

Requires gasket or O-ring for seal

Mid-tier
HDPE

- Contamination and dust prevention
- Suitable for ambient environments
- Impact resistance
- Excellent chemical resistance

Requires gasket or O-ring for seal

Premium
EPDM

- Contamination and dust prevention
- Very good temperature range
- Good impact resistance
- Withstands low pressures
- Excellent chemical resistance

Requires gasket or O-ring for seal

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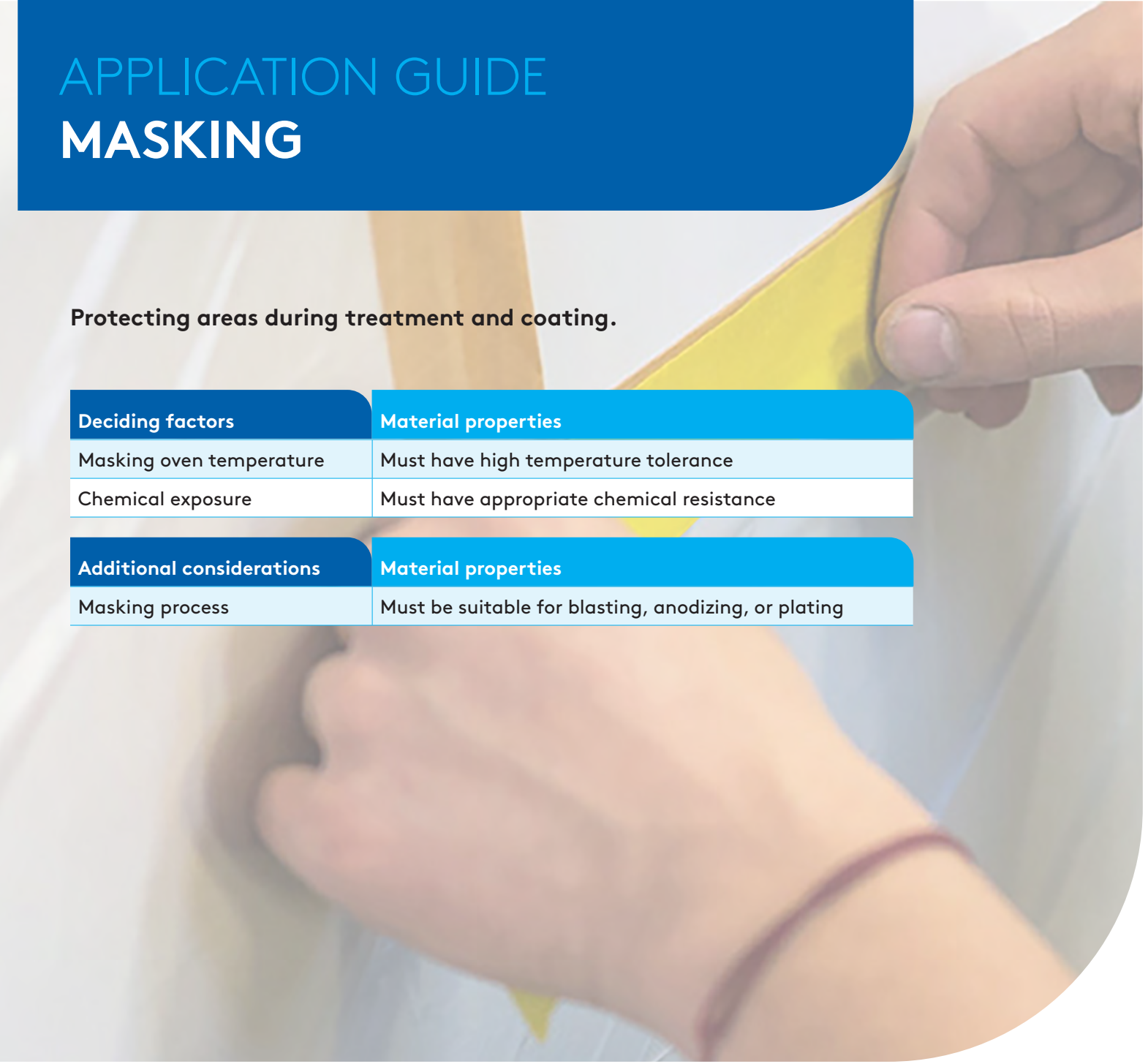
APPLICATION GUIDE
MASKING



Protecting areas during treatment and coating.

Deciding factors	Material properties
Masking oven temperature	Must have high temperature tolerance
Chemical exposure	Must have appropriate chemical resistance

Additional considerations	Material properties
Masking process	Must be suitable for blasting, anodizing, or plating

Entry level
High-temp Vinyl

- Very good temperature range (400°F)
- Very good chemical resistance
- Suitable for all masking processes

Only available as a cap

Mid-tier
EPDM

- Very good temperature range (400°F)
- Excellent chemical resistance
- Suitable for all masking processes

Premium
Silicone

- Excellent temperature range (600°F)
- Excellent chemical resistance
- Suitable for all masking processes

All material suggestions are for illustrative purposes only.
Contact Essentra for specific recommendations

APPLICATION GUIDE
PART HANDLING & TRANSPORT

Protecting areas during handling, transit, or storage.

Deciding factors	Material properties
Impacts and abrasion	Must withstand knocks and scratches
Ambient temperature	Must have suitable temperature tolerances
Contamination	Must prevent particle and dust ingress
Moisture exposure	Must have suitable moisture resistance

Additional considerations	Material properties
Long-term environmental exposure	Must have suitable UV and weathering tolerance
Travel distance	Higher densities support longer transits
Chemical exposure	Must have appropriate chemical resistance

Entry level
LDPE

- Low impact resistance
- Suitable for ambient environments
- Contamination and dust prevention
- Poor UV resistance
- Low density
- Good chemical resistance

Mid-tier
TPE

- Good impact and abrasion resistance
- Reasonable temperature tolerance
- Contamination and dust prevention
- Excellent weather resistance
- Excellent chemical resistance
- Low density
- Flexible (stays on product)
- Recyclable

Premium
Vinyl / PVC

- Excellent impact and abrasion resistance
- Very good temperature tolerance
- Contamination and dust prevention
- Good weather resistance
- Very good chemical resistance
- Higher density
- Flexible (stays on product)

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Contact Essentra for specific recommendations

ADDITIONAL **CONSIDERATIONS**

Beyond material choice selection.

THERE'S A LOT MORE TO CAP AND PLUG SELECTION THAN MATERIAL CHOICE.

Form factor

Ergonomics

Paired components

Material selection is a crucial step in your cap and plug selection journey.

Identifying the correct type, application and removal process, along with any complementary components comes next.

Consider the following:

- Push or screw fit
- Threaded or unthreaded
- Tapered or straight
- Flanged or smooth
- Measured or stretch fit
- Hexagonal or round top
- Tool-friendly
- Quick-fit and removal
- Reusability
- O-ring or gasket pairings

With over 60,000 products available to choose from, we're certain to have perfect solution for you.

Feeling overwhelmed?

Essentra support teams are on hand to help guide you through the decision-making process.

THE ESSENTRA **ADVANTAGE**

ESSENTRA IS THE LEADING MANUFACTURER OF PLASTIC INJECTION, VINYL DIP, AND ACCESS HARDWARE SOLUTIONS.

- Portfolio of 60,000+ products
- 1 billion parts in stock, ready for dispatch
- Extensive standard range of caps and plugs
- Large selection of available materials

Free sampling

We always recommend sampling to ensure compatibility, and best of all, it's completely free.

Even if the product doesn't fit your exact requirements, feel free to order a sample or call one of our on-hand experts to find the one that does.

Global support

Our global support teams are here to help you solve your challenges wherever you are.

- Operating in 28 countries across 4 continents
- Over 2,500 service and solutions experts
- 14 manufacturing facilities, 24 distribution centres, and 33 sales and service locations

Bespoke solutions

Whether it's adapting a standard part or developing an entirely new product, we support design and prototyping through to global-scale manufacturing and distribution.

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NEXT STEPS

With hassle-free service, expert advice, and free samples, we're here to make life easier for you. Just let us know how we can help.

Explore our full range of solutions at **essentracomponents.com** — or connect with your dedicated Essentra team in your region today.

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