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Company with quality management system certified byTÜV Italia Srl according to ISO 9001 standard and by IMQ SpA according to ISO 13485 standard. Company with environmental management system certified by IMQ SpA according to ISO 14001 standard. Company with an occupational health and safety management system certified by IMQ SpA in accordance with ISO 45001.

Lafer
RIVESTIMENTI PVD-PACVD-DLC

TECHNICAL REQUIREMENTS

1. Contents of the document

In this document are reported some technical requirements which have to be observed to easily process the parts.

2. Parts dimensions

The maximum dimensions allowed for coating are contained in a cylinder of Ø900mm x 1500mm.
Exceptionally, larger overall dimensions may be considered to be evaluated on a case-by-case basis, also depending on the required coating.
The technical office can evaluate the feasibility of bigger dimensions, based on the coating type.

3. Surface characteristics

- The surfaces must be without burnishing, vaporization, Teflon or anodizing treatments.
- Residue of oxidation, thermal treatments, processed material (e.g. Plastic, rubber, other metals, etc.), glue, paints, scotch tape must not be present on the parts.
- Residual burrs or burns must not be present on sharp edges.
- Pens, felt-tip pens or marking pens must not be used to identify functional areas: attach the technical drawing to the goods instead. If not otherwise specified, Lafer could coat other not functional areas.
- We suggest protecting the parts with oil after machining (e.g. Chemetal Gardolube L8255 or equal). Do not use dewatering oils or silicone-based protective oils.
- Photoengraved surfaces are suitable for Lafer coating.
- After nitriding, the white layer must be removed from the surfaces through grinding.
- The parts should have holes or threads, so they can be fixed to the coating fixtures.
- In case of hardened parts, the tempering temperature has to be higher than the coating process temperature.
- Steel parts must be sent to Lafer already demagnetized.

4. Polishing

- The surface roughness of the functional areas has to be less than Ra 0,20 µm (based on the characteristics of the mold, tool or item). If it is not possible to fulfil this requirement, tailored Lafer Polishing process can be performed in Lafer.
- The final surface roughness achievable on parts after the Initial Lafer Finishing A1 process depends on their original roughness value. This process may result in rounding sharp edges. Material removal, achievable surface roughness, and edge rounding may vary depending on part geometry, weight, base material type, and material hardness.
- The surfaces must not be polished with rubber tools.
- The polishing process with diamond paste must not include particles inside the surface. Diamond pastes with particles smaller than 3µm must be avoided.

5. Brazing

Brazing alloy must resist to high vacuum ($8x10^{-6}$ mbar), it must not contain Cadmium and Zinc (or other r low melting elements) and it must resist to a temperature of at least 600°C without degassing.

6. Decoating

STEEL: it is possible to completely remove the PVD coating from tools, molds and other steel components.
We particularly suggest performing the decoating process before a new recoating of cutting tools and plugs for aluminum die-casting.
ALUMINUM: it is not possible to chemically remove Superlattice and New Chrome coatings deposited on aluminum alloys. DLC and WC/C coatings are difficult to remove. This operation may alter the original surface finish grade, cause slight dimensional variations, and round off any sharp edges.
HARD METAL (HM): it is possible to completely remove PVD coatings from tools and surfaces made of Hard Metal.
TITANIUM ALLOYS: it is not possible to remove Titanium PVD coating from Titanium alloys.
NICKEL ALLOYS: it is not possible to remove Chromium PVD coatings from Nickel alloys and surfaces with a Nickel based coating.
CHROMIUM ALLOYS: it is not possible to remove Chromium PVD coatings from Chromium alloys or surfaces with a Chromium based coating.

7. Molds and assembled parts preparation

All assembled parts must be completely disassembled. If some parts cannot be disassembled, assembling instructions must be provided. In these cases a further work phase (“Degas”) with separated quotation is necessary.
Cooling holes and lubrication tubes must be open and cleaned with solvent. Screw off all the cooling-lubrication caps or close the tubes with copper sealing caps.
Polishing of functional areas must be extended to the adjacent areas, in order to guarantee a regular coating adhesion.
In case of molds for plastic molding, this operation must be performed before creating closing profiles or fine tuning.
Protect surfaces after machining with oil (e.g. Chemetal Gardolube L8255 or equal). Avoid any kind of grease.
In case of welding for profile recovery, use the same material of the substrate.

8. Necessary information for the correct execution of the coating

Attach the following information to the material to be coated:

- Construction drawing or sketch, where the following must be clearly indicated: functional surface, geometric tolerances, areas where coating is required, allowed, or not permitted;
- Type of material and any heat treatment (quenching and tempering temperature);
- Contact material (molded or counterpart);
- Working or molding conditions (e.g., dry, lubrication, etc.).

9. Packaging and shipment

- Packaging of 30kg weight or heavier must be palletized.
- The receiving area is equipped with motorized conveyor belts.
- The packaging must be suitable for protecting and not damaging the goods during transport. The same packaging will be used for the shipment from Lafer. In case of repetitive shipment, Lafer plastic boxes are available.
- Avoid pluriball in direct contact with surfaces. Always place a paper layer between pluriball and goods.
- The goods travel at the risk of the customer even if they are sent with prepaid transportation.

ACCIAI IDONEI AI RIVESTIMENTI PVD-PACVD LAFER

SELECTION OF STEELS SUITABLE FOR LAFER PVD-PACVD COATINGS

	WERKSTOFF	DIN	AISI	BÖHLER	UDDHEHOLM	ALTRI / OTHERS	HRC MAX	PVD	SLC	DLC	DUPLEX
Acciai rapidi e superrapidi	1.3343	HS6-5-2C	~M2 reg.C	S600		ERASTEEL M2	66	▲	■	●	✖
	1.3344	HS6-5-3	~M3 Cl.2	S607			66	▲	■	●	✖
High speed steels	1.3243	HS6-5-2-5	~M41 (~M35)	S705		ZAPP SSLB 50 / ERASTEEL M35	66	▲	■	●	✖
	1.3247	HS2-9-1-8	M42	S500 ISORAPID		ERASTEEL M42	69	▲	■	●	✖
Acciai per lavorazioni a freddo	1.2080	X210Cr12	~D3	K100		ZAPP C 120	62		■	●	
	1.2379	X153CrMoV12	D2	K110	SVERKER 21	DÖRRENBERG CP4M	62	▲	■	●	●
	1.2363	X100CrMoV5	A2	K305	RIGOR	ZAPP LVC 50	62		■	●	
				K340 ISODUR	SLEIPNER		63	▲	■	●	●
				K360 ISODUR			63	▲	■	●	●
				K353	CALDIE	ZAPP US2000	62	▲	■	●	●
	1.2358	60CrMoV18-5			CALMAX		62		■	●	
Cold work tool steels	1.2436	X210CrW12	(~D6)	K107	SVERKER 3	ZAPP WC 120	63	▲	■	●	✖
	1.2510	100MnCrW4	O1	K460	ARNE		62		■	●	
	1.2721	50NiCr13		K605			56		■	●	
	1.2767	45NiCMo16 (X45NiCrMo4)		K600		ZAPP LCN 45	54		■	●	
	1.2842	90MnCrV8	~O2	K720		ZAPP VM 20	62			●	
	1.2550	60WCrV7	S1	K455			60			●	
Acciai per lavorazioni a caldo	1.2343	X37CrMoV5-1	H11	W300 ISOBLOC / W400 VMR	VIDAR SUPERIOR	ZAPP CVL 10	54	▲	■	●	●
				W360 ISOBLOC	~DIEVAR		57	▲	■	●	●
	1.2344	X40CrMoV5-1	H13	W302 ISOBLOC	ORVAR SUPREME	HITACHI DAC-MAGIC	55	▲	■	●	●
				W350 ISOBLOC	~DIEVAR		53	▲	■	●	●
	1.2365	32CrMoV12-28	~H10	W320 ISODISC	QR0 90 SUPREME	ZAPP CVL 30	52	▲	■	●	●
Hot work tool steels	1.2367	X38CrMoV5-3		W303 ISOBLOC / W403 VMR		ZAPP LC 50	54	▲	■	●	●
				W360 ISOBLOC	UNIMAX		57	▲	■	●	●
	~1.2343	~X37CrMoV5-1	~H11	W400 VMR			54	▲	■	●	●
	1.2709			W722 VMR		MARAGING 300	54	▲	■	●	●
Acciai da stampi materie plastiche	1.2312	40CrMnMoS8-6	~P20	M200			53	▲	■	●	●
	1.2311	40CrMnMo7	~P20	M201		ZPP MCL 3	53	▲	■	●	●
	1.2738	40CrMnNiMo8-6-4	~P20	M238 / M268 VMR	~IMPAX SUPREME	ZAPP MCL 4	52	▲	■	●	●
			~420	M333 ISOPLAST	MIRRAX ESR / MIRRAX 40		50	▲	■	●	✖
	~1.2083	X40Cr14	~420	M310 ISOPLAST	~STAVAX ESR	ZAPP C 135 M	52	▲	■	●	✖
Plastic mould steels	~1.2085	~X33CrS16		M314 EXTRA	~RAMAX HH / ROYALLOY		50	▲	■	●	
				M340 ISOPLAST	~TYRAX ESR		56	▲	■	●	✖
	~1.2316	~X38CrMo16		M303 EXTRA		ZAPP LC 160	51	▲	■	●	●
	1.4108	X30CrMoN15-1		M380 ISOPLAST			61	▲	■	●	
	1.2714	55NiCrMoV7	~L6	W500	ALVAR 14		61	▲	■	●	●
Acciai prodotti mediante metallurgia delle polveri	1.3345	HS6-5-3C	~M3 Cl.2	S790 MICROCLEAN	VANADIS 23	ERASTEEL ASP2023	66	▲	■	●	✖
				M390 MICROCLEAN	ELMAX SUPERCLEAN	ZAPP CRUCIBLE CPM S30V	61	▲	■	●	✖
				M368 MICROCLEAN			54	▲	■	●	●
						ZAPP CRUCIBLE CPM 3V	58	▲	■	●	
					VANADIS 8 SUPERCLEAN	ZAPP CRUCIBLE CPM 10V	64	▲	■	●	✖
					VANCRON SUPERCLEAN		65	▲	■	●	✖
				K890 MICROCLEAN	~VANADIS 4 EXTRA SUPERCLEAN		64	▲	■	●	✖
					VANADIS 6		63	▲	■	●	●
		HS 1-4-9-2		K390 MICROCLEAN			64	▲	■	●	
						ZAPP CRUCIBLE CPM 420V	57	▲	■	●	
Powder metallurgy steels				K490 MICROCLEAN			64	▲	■	●	●
			M48			ZAPP CRUCIBLE CPM REX76 / ERASTEEL ASP2048	68	▲	■	●	
	~1.3351	~HS6-5-4	~M4	S690 MICROCLEAN		ZAPP CRUCIBLE CPM REX M4	66	▲	■	●	●
	1.3244	HS6-5-3-8		S590 MICROCLEAN	VANADIS 30 SUPERCLEAN	ERASTEEL ASP2030	67	▲	■	●	✖
	~1.3292	~HS4-3-8			VANADIS 60 SUPERCLEAN	ERASTEEL ASP2053	69	▲	■	●	✖
				S290 MICROCLEAN			70	▲	■	●	●
				S390 MICROCLEAN	VANADIS 4 EXTRA SUPERCLEAN	ZAPP CRUCIBLE CPM REX T15	69	▲	■	●	✖
				MC-90 MICROCLEAN			68	▲	■	●	
	~1.2380	X230CrVMo13-4		K190 MICROCLEAN			63	▲	■	●	
Acciai inox Stainless steels	1.4034	X45Cr13	420	N540			52	▲	■	●	
	1.4028	X30Cr13	420B				48	▲	■	●	
	1.4021	X20Cr13	420A	T651			28	▲	■	●	
	1.4024	X15Cr13	410				25	▲	■	●	
	1.4108	X30CrMoN15-1		N360 ISOEXTRA		~NICRO 85 / NICRO 100	60			●	
	1.4112	X90CrMoV18	~440B	N685 EXTRA		ZAPP K90L	59		■	●	
	1.4125	X105CrMo17	440C	N695 EXTRA			60	▲	■	●	
	1.4301	X5CrNi18-10	304	A500			200 HB	▲	■	●	
	1.4401	X5CrNiMo17-12-2	316	A120			200 HB	▲	■	●	
	1.4528	X105CrCoMo18-2		N690 EXTRA			60		■	●	
	1.4542	X5CrNiCuNb16-4	630	N700 VMR		~NICRO 175 HQ	48	▲	■	●	✖

Altri materiali idonei ai rivestimenti PVD-PACVD Lafer

Other materials that can be PVD-PACVD coated by Lafer

Acciai per componenti racing Aubert&Duval / Aubert and duval steels

GKHW - GH4 - BMV4 - NC310YW - RA50YW

Acciai da cementazione / Case carburizing steels

X6 CrMo 4 - 16CrNiMo 12 - 18 NiCrMo 5 - 20 NiMo 2
16NiCr 4 - 16 MnCr 5 - 21 MnCr 5

Acciai da nitrurazione / Nitriding steels

14 CrMoV 6-9 - 34 CrAlNi 7 - 38 CrAl o 7 - 34 CrAlNi 7
40 CrAlMo 7 - 31CrMo V 9 - 31 CrMo 12 - 42 CrMo 4

Leghe di rame / Copper alloys

Leghe di alluminio / Aluminum alloys

Leghe di titanio / Titanium alloys

HM carburo di tungsteno / Tungsten carbide (WC)

N.B. La temperatura dell'ultimo rinvenimento deve essere superiore alla temperatura di coating. Le corrispondenze tra gli acciai sono indicative. Last tempering temperature has always to be higher than coating deposition temperature. Correspondance between steel types may only be considered to be indicative.

▲ PVD - Rivestimenti PVD-PACVD con temperatura di coating di 450°C / PVD-PACVD coating with deposition temperature of 450°C: Kronos, TiN, Red Speed, Tigral, Hyperlox, Sintal, Zirinos, Duplex Durmatic, Durlafer

■ SLC - Rivestimenti PVD-PACVD con temperatura di coating di 280°C / PVD-PACVD coating with deposition temperature of 280°C: Superlattice, New Chrome

● DLC - Rivestimenti PVD-PACVD con temperatura di coating di 180°C / PVD-PACVD coating with deposition temperature of 180°C: DLC, Carbonlafer

● Duplex - Durlafer: fattibile / suitable

✖ Duplex - Durlafer: sconsigliati / to be avoided

Scala di comparazione durezze / Hardness conversion table

HV	HRC	HV	HRC
2000	(82)	1200	(71)
1800	(79)	1100	(70)
1600	(77)	1000	(69)
1500	(75)	900	(67)
1400	(74)	800	(64)
1300	(72)	700	(60)