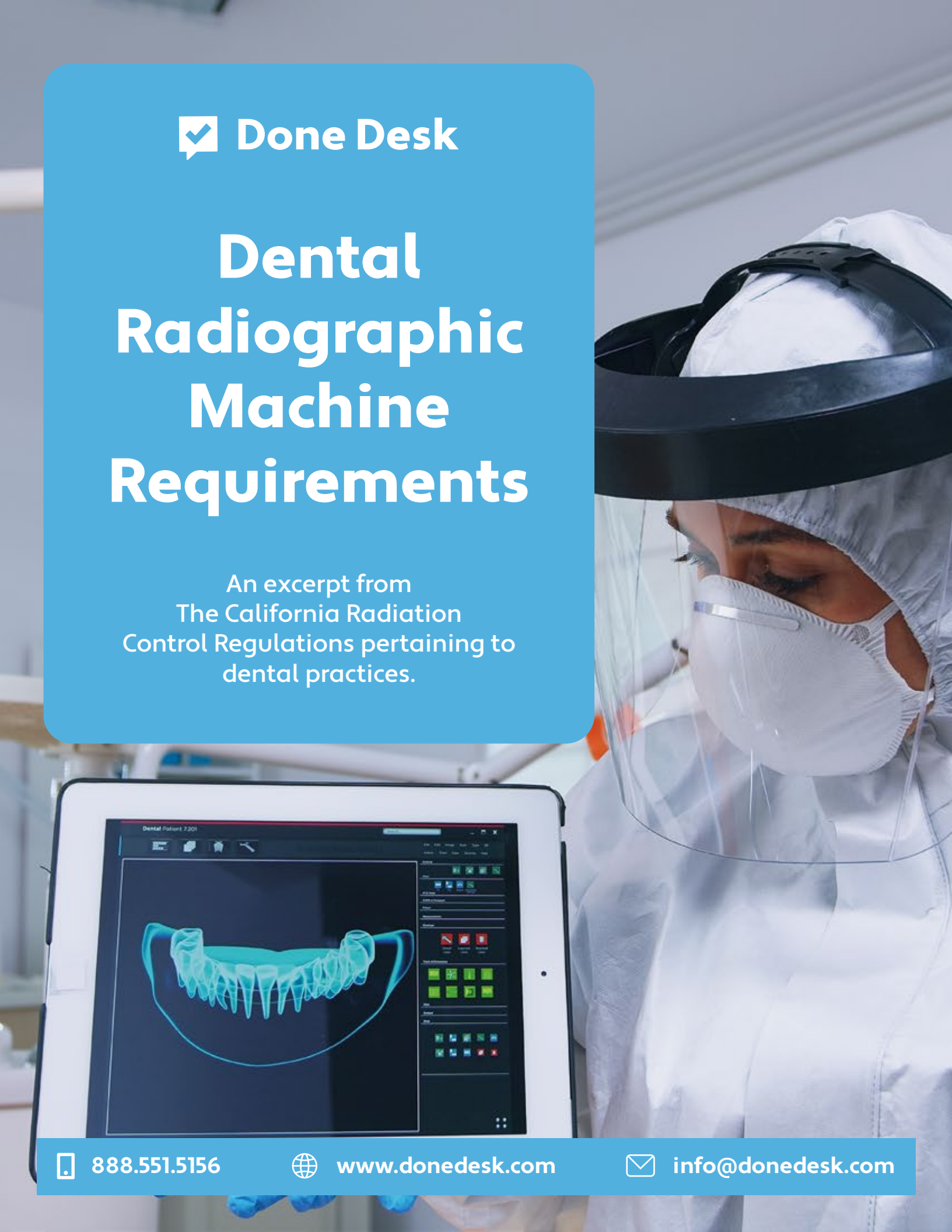
Done Desk

Dental Radiographic Machine Requirements

An excerpt from
The California Radiation
Control Regulations pertaining to
dental practices.



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X-ray Tube Housing

The X-ray beam is generated within a vacuum tube containing a cathode with a tungsten filament, and an anode "target," usually made of copper and tungsten.

The X-ray tube itself is enclosed in a metal housing, with a window (port) through which the useful or primary X-ray beam passes.

The X-ray tube housing must be of a diagnostic type. A "diagnostic type tube housing" is the type of tube housing constructed so that leakage radiation does not exceed 100 mrems, or 1mSv, in any one hour at a distance of 1 meter (39.37 inches) from the X-ray tube. Note that this definition acknowledges that radiation can escape the X-ray tube housing from areas other than the window (port).

X-ray Tube Housing

X-rays that extend beyond the area of the dental image receptor (i.e., film, PSP, CCD, or CMOS) serve no useful purpose and should be eliminated to the maximum extent practicable.

The X-ray beam shall be restricted to a diameter of not more than 7 cm (2.75 inches) in diameter at the surface of the skin. This size of the X-ray beam is sufficient to allow for reasonable alignment errors.

It is highly desirable to add a rectangular collimator that limits the X-ray beam to a size just larger than that of the dental image receptor used.

This can be accomplished by either adding a rectangular collimator adapter to the aiming cylinder, replacing the aiming cylinder with a rectangular collimator model, or by incorporating a rectangular collimator into the film holding device.

Restriction of the X-ray beam size reduces the total area of exposure and helps avoid exposure outside the area being examined for dental work.

X-ray Beam Filtration

The primary X-ray beam is made up of X-rays of different energies. Only the X-rays with higher energies can penetrate the tissue of the patient's face and react with the image receptor area (i.e., film, PSPP, CCD, CMOS). Low-energy X-rays that have no effect on image production and are absorbed by the tissues, can cause tissue damage. A filter functions by absorbing preferentially more of the low-energy (long wavelength) X-rays before they reach the patient, while allowing more of the high-energy (short wavelength) X-rays to pass through.

Some X-ray tubes within the X-ray tube head are surrounded by oil (except the "window" through which the useful or primary X-ray beam passes) for electrical insulation and to keep the X-ray tube from overheating. X-ray beam filtration is accomplished by placing a filter (usually aluminum) in the path of the useful or primary beam to absorb some of the low-energy X-rays before they reach the patient. The total filtration of an X-ray beam includes inherent filtration and the added filtration (discussed above).

Inherent filtration, which is a permanent part of the X-ray tube, includes the X-ray tube housing, the oil and the glass envelope (window) through which the primary or useful X-ray beam passes. The amount of inherent filtration produced by most diagnostic X-ray tubes usually ranges from 0.5 to over 2.0 mm aluminum-equivalent. Added filtration includes sheets of metal (usually aluminum) placed in the direct path of the X-ray beam between the port and the patient. Added filtration can be changed or modified, as required. Proper filtration for the dental X-ray unit is provided by the manufacturer and need not be modified in most cases. Diagnostic X-ray tubes use aluminum or an aluminum-equivalent as the filter material. ("Aluminum-equivalent" is defined as a substance equivalent to aluminum in its ability to absorb preferentially less penetrating radiation.)

The regulations specify the minimum total filtration as shown below:

Tube Operating Potential (kV)	**Minimum Total Filter** (inherent plus added) (millimeters of aluminum or aluminum-equivalent)
Below 50	0.5
50 to 70	1.5
71 and above	2.5

Exposure Cord

The exposure switch must be permanently fixed in a safe shielded location or the exposure cord on a remote hand switch must be long enough to permit the operator to make exposures while positioned at least six feet from the patient. This six-feet distance must also be between 90°-135° to the direction of the primary X-ray beam.

Exposure Timer

The X-ray machine must have a device to terminate the exposure after a preset time or exposure. This is usually in the form of a “dead-man” type exposure switch. This type of switch requires constant pressure from the operator in order for the machine to function.

X-ray Tube Head and Flexible Arm Assembly

The flexible extension arm allows the X-ray tube head to be adjusted to various positions required for dental radiography. The mechanical support of the X-ray tube head and cone shall maintain the exposure position without drift or vibration.

Portable X-ray Units

1. The portable dental X-ray system being used must have FDA approval and must be used in a manner consistent with that approval.

2. The unit must have a manufacturer-provided backscatter shield that is not less than 0.25 mm lead equivalent. The shield must be permanently affixed in place at all times. The X-ray system may not be used if this component becomes broken or dislodged.

Cone Beam Computed Tomography (CBCT) Units

Maintain these units following manufacturer’s recommendations. The units also should be tested by knowledgeable technicians on a periodic basis if not already part of the manufacturer’s recommendations