

**TOSHIBA**

*Toshiba X-ray Tube*

**1915 - 2005**

**HISTORY**



**TOSHIBA ELECTRON TUBES & DEVICES CO., LTD.**

# Over the last 90 years, TOSHIBA ELECTRON TUBES & DEVICES CO., LTD. has been a major supplier of key components for medical and industrial X-ray systems.

1895 ● Discovery of the X-ray by Röntgen

1913 ● Invention of heat electron cathode X-ray tube by Coolidge (USA)

1914 ● Start of X-ray tube development

1915 ● Start of manufacturing GIBA X-ray tube (ion tube) (First developer in Japan)

1917 ● Start of manufacturing GIBA X-ray tube with Tungsten electrode

1920 ● Start of manufacturing Coolidge tube (U type)  
● Start of manufacturing Kenotron (For high voltage rectifier: KR-20, KR-100)

1924 ● Start of manufacturing Coolidge tube (For radiation therapy: H type)  
● Development of analytic X-ray tube (Coolidge M type)

1925 ● Start of manufacturing Coolidge tube (For radiography: R type)

1931 ● Completion of X-ray shielded Coolidge tube "JAPANIX"

1934 ● Completion of high voltage protective oil-sealed X-ray tube assembly (SP Coolidge tube)  
● Start of manufacturing double focus X-ray tube

1935 ● Completion of analytic X-ray tube "SELEX" (SW-3 type)

1938 ● Completion of air cooling rotational anode X-ray tube (SP-RA)

1944 ● Air cooling rotational anode X-ray tube (SDN-R-60) released, but was destroyed during World War II

1949 ● Completion of oil-sealed rotational anode X-ray tube assembly (XDO-R-60)

1952 ● Release of multi-cooling (air or water) X-ray tube (SDWR-10,6, DF-10/2)

1953 ● Completion of rotational anode X-ray tube (SDO-R-70)

1955 ● Start of manufacturing grid controlled stationary anode X-ray tube (DS-503R) (First developer in the world)

● Development of rectifying tube Kenotron (K-23, K-33) using "ThO<sub>2</sub>-W" filament

"ThO<sub>2</sub>-W (Thoriated Tungsten)" is the trade mark of TOSHIBA MATERIALS CO., LTD

● Completion of super-small dental X-ray tube (D-081)

## GIBA X-ray tube (Ion tube)

First developed X-ray tube in Japan using Pt electrode (Photo). In 1917, manufacturing starts using tungsten electrode.



## Shield type Cooling tube (JAPANIX)

First developed shield type X-ray tube in Japan. The shielding cover is made of lead plate and plastic.



## Air cooled rotational anode X-ray tube (SP-RA)

First developed rotational anode X-ray tube in Japan.



## Rotational anode X-ray tube (SDO-R-70)

Higher anode heat content X-ray tube than former model XDO-R-60



## Super-small dental X-ray tube (D-081)

Physical dimensions are dramatically down-sized and still continue to be sold.



Since the manufacture of Japan's first X-ray tube in 1915, we have been in the forefront position of X-ray tube development for 90 years. Based on the basic Commitment of the Toshiba Group "Committed to People, Committed to the Future.", we are very proud to be one of the world's largest X-ray tube manufacturers in the healthcare and industrial fields.

**1956** ● The brand name "ROTANODE" is used for TOSHIBA rotating anode X-ray tube  
"ROTANODE" is the trade mark of TOSHIBA ELECTRON TUBES & DEVICES CO., LTD.

**1957** ● Completion of grid controlled ROTANODE (DR-56, DR-76, DR-86)

● The brand name "ANALIX" is used for TOSHIBA analytic X-ray tube  
"ANALIX" is the trade mark of TOSHIBA ELECTRON TUBES & DEVICES CO., LTD.

● The brand name "MATSUDA" is changed to "TOSHIBA"

**1958** ● Development of small focus ROTANODE (Nominal focal spot size 0.3mm)

**1959** ● Completion of ANALIX A-15 (Diffraction type) & AF-50 (Fluorescence type)

**1960** ● Completion of invasive therapy X-ray tube (T-2532, T-2533: The world largest anode heat content)

● Completion of ROTANODE with  $\phi 100$  anode target diameter (DR-150/M5137)

● Completion of ROTANODE with off-focal X-ray shielding (DR-80S)

● Completion of medical use 15MeV Betatron (First developer in Japan)

**1961** ● Completion of small sized ROTANODE (DR-31)

● Completion of cathode biasing small focus ROTANODE for magnified radiography use (DR-89: nominal focal spot size  $50\mu\text{m}$ )

● Completion of ANALIX for mechanical stress measurement (A-30)

### ROTANODE DRX-B20/M5192X

Mammography X-ray tube with Be X-ray port obtaining lower X-ray energy.



### ROTANODE for 3 dimensional imaging

Angiography X-ray tube with 2 X-ray ports making 3 dimensional imaging method useful.



**1963** ● Completion of grid controlled small sized ROTANODE (DR-66, DR-67)  
● Completion of small focus ANALIX (A-18)

**1964** ● Development of high speed rotational ROTANODE (DR-90H/M5156: 9000rpm)

**1965** ● Completion of gas-insulated industrial X-ray tube (I-715B)

**1966** ● Completion of Be X-ray port mammography ROTANODE (DRX-B20/M5192X)

● Completion of W-Mo anode target ROTANODE (DR-190)  
● Completion of Be X-ray port industrial X-ray tube (I-320)

**1967** ● Development of filament switching type dual cathode ROTANODE for 3 dimensional imaging

**1968** ● Completion of Be X-ray port ANALIX (A-20)

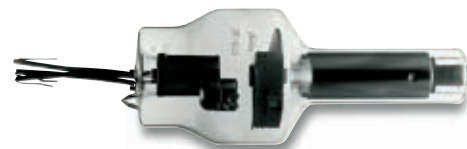
### ANALIX A-15

Diffraction X-ray tube with Mica X-ray port. The A-20, completed in 1968, is the first product ever to make use of the Be X-ray port.



### ROTANODE DR-80S

Off-focal X-ray reduces X-ray tube 60% by shielding anode target with 0.5mm thickness Mo cover.



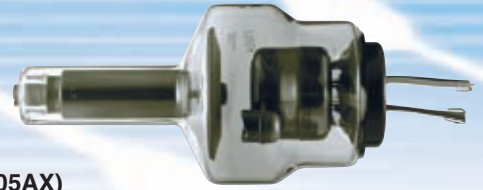
### ANALIX A-30

Analytic X-ray tube for measuring mechanical stress by diffraction



## 200kHU ROTANODE E7005AX

Radiography X-ray tube with  $\phi 100$  target with increased input power.



1970 ● Development of 200kHU anode heat content ROTANODE (E7005AX)

1971 ● Completion of grid controlled high power ROTANODE for magnified radiography (E7027X)

1973 ● Release of high power ROTANODE for magnified radiography (DR-431H: nominal focal spot size 0.1mm)  
● Release of self biased dental X-ray tube

1975 ● Development of graphite target ROTANODE

1976 ● Development of multi-orbit tomography ROTANODE (DRX-1924HD)

1977 ● Development of 300kHU ROTANODE

● Development of 200kV ceramic-enveloped X-ray tube for non-destructive inspection (I-670)

## Industrial X-ray tube I-670

Non-destructive inspection X-ray tube with ceramic envelope to increase high voltage stability of 200kV



1978 ● Development of stationary anode X-ray tube for cefalo CT (CX-111)  
● Total of 100 thousand ROTANODE units Produced

1979 ● Development of 400kHU ROTANODE

## ROTANODE for 3 dimensional imaging

Angiography X-ray tube with X-ray cut-off biasing of world fastest switching speed of 100 times per second



1980 ● Development of world fastest filament switching type dual cathode ROTANODE for 3 dimensional imaging

## 1.5MHU ROTANODE

CT use X-ray tube with huge anode heat content using graphite target



● Development of 500kHU ROTANODE ( $\phi 125$  target diameter)  
● Development of 300kHU ROTANODE with heat exchanger (DRX-3224HD-H)

1981 ● Development of metal-enveloped ROTANODE for mammography (DRX-B1046E-Mo)  
● Development of 300kV ceramic-enveloped X-ray tube for non-destructive inspection (I-870)

1983 ● Development of 1.5MHU (graphite) ROTANODE for whole body CT

## 1.8MHU ROTANODE DRX-T7345HD-H

Angiography X-ray tube with 3 focal spot size utilizing magnified fluoroscopy, radiography, and angiography



● Development of 750kHU ROTANODE for whole body CT (CRX-5933HD-H)

1986 ● Development of 800kHU ROTANODE with heat exchanger  
● First participation in RSNA exhibition as medical tube components division

1987 ● TOSHIBA Electron tube division in HORIKAWA-CHO works moves to NASU area

1988 ● Development of 1.8MHU ROTANODE for whole body CT

1990 ● Development of world best-seller ROTANODE for radiography (E7239X)

● Development of 1.8MHU tri-focus ROTANODE for angiography (DRX-T7345HD-H)

● Development of dual cathode with double focus ROTANODE for 3 dimensional imaging (DRX-W735HD-H)

1991 ● Development of high power ROTANODE for mammography (DRX-B3057EB-Mo)

● Total ROTANODE production reaches 200 thousand units

- 1992 ● Application of anti-heat conduction anode design for angiography ROTANODE
- Development of 60 $\mu$ m Be X-ray port fluorescence type ANALIX (AFX-76UT)
- 1993 ● Development of 1.5MHU ROTANODE for cardiac diagnosis (DRX-7234HD-H)

### 4MHU ROTANODE "HeliCool" CSRX-7713D-H

"HeliCool" is a trademark of TOSHIBA MEDICAL SYSTEMS CORPORATION  
Helical sub-second scanning CT use X-ray tube cooperated with Hydro-Dynamic bearing and all-metal target



- 1994 ● Development of Hydro-Dynamic bearing, 4MHU ROTANODE "HeliCool" for Helical scanning CT (CSRX-7713D-H)

- Development of high speed anode rotation ROTANODE for mammography (DRX-B3157HEB-Mo)

### R/F table ROTANODE DRX-6645D/E7291X

R/F X-ray tube with light weight target to boot-up rotor quickly



- 1995 ● Development of 1.8MHU water cooling ROTANODE for angiography
- Development of 600kHU ROTANODE for R/F table (DRX-6645D/E7291X)

- Development of metal-ceramic enveloped X-ray tube (A-50)

### Continuous 3kW ANALIX AFX-77L-Rh

Analytic X-ray tube making use of 30 $\mu$ m Be X-ray port to intensify the characteristic radiation of Rh-L $\alpha$  three-fold



- Development of continuous 3kW fluorescence type ANALIX with 30 $\mu$ m Be X-ray port (AFX-77L-Rh)

### Double focal track ROTANODE E7290AX

Mammography X-ray tube with 2 target angles and focal spots size optimum for magnification radiography



- Development of double track ROTANODE for mammography (E7290AX)

- Application of anti-heat conduction anode design for R/F ROTANODE

- 1996 ● Development of water cooling ROTANODE for angiography (DRX-T7345HD-H,S)

- 1997 ● Development of 100 $\mu$ m focus size industrial X-ray tube (I-311)

### Grid controlled ROTANODE DRX-T7345HD-H,S

Angiography X-ray tube cooperated with Pulse Fluoroscopy applicable cathode



1998 ● Development of grid controlled ROTANODE for angiography (DRX-T7345HD-H,S)

● Development of continuous 4kW fluorescent type ANALIX with 30 $\mu$ m Be X-ray port (AFX-88L)

1999 ● Development of world best seller double focus stationary anode X-ray tube for mobile C-arm (DF-151)

2000 ● Development of grid controlled ROTANODE for R/F table (DRX-6645GD)  
● Development of food inspection X-ray tube (I-312)

2001 ● Development of 3MHU ROTANODE with high speed rotational Hydro-Dynamic bearing for angiography (DSRX-T7444GDS)

### 3MHU continuous high speed ROTANODE DSRX-T7444GDS

Angiography high power X-ray tube cooperated with Hydro-Dynamic bearing

● Development of 4MHU ROTANODE "HeliCool" with medium speed rotational Hydro-Dynamic bearing for Helical scanning CT (CSRX-9144MD-H)  
● Total dental X-ray tube production reaches 500 thousand units  
Total "HeliCool" production reaches one thousand units

### 1.8MHU ROTANODE DRX-T7345GFS

Angiography X-ray tube cooperated with anti-heat bearing design to reduce rotor noise



2002 ● Development of 1.8MHU ROTANODE with lead lubricant high speed rotational bearing for angiography (DRX-T7345GFS)

### Micro-focus X-ray tube with power supply IXR-M313

Non-destructive inspection use X-ray tube with 6 $\mu$ m focal spot and transmittable target



2003 ● Development of micro-focus (6 $\mu$ m) X-ray tube with power supply (IXR-M313)

● Development of 4MHU ROTANODE "HeliCool" with high speed rotational Hydro-Dynamic bearing for Helical scanning CT

2005 ● Development of 300kHU ROTANODE for mobile C-arm (E7841X)  
● Development of anode grounded ROTANODE with dual support Hydro-Dynamic bearing

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1915 - 2005  
**HISTORY**

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