



face value	100 zł
metal	900/1000Au
finish	proof
diameter	21.00 mm
weight	8.00 g
mintage	8,000 pcs

Obverse: In the central part, an image of the Eagle established as the state emblem of the Republic of Poland. In the background, tables of letters and an outline of the Enigma cipher machine operation diagram. A semicircular inscription, RZECZPOSPOLITA POLSKA, the notation of the year of issue, 2007 and an inscription, 100 ZŁ. The Mint's mark, $\frac{m}{w}$, incorporated into the tables of letters, under the Eagle's left leg.

Reverse: On the left and on the right, stylised light bulbs from the Enigma cipher machine, surrounded by two groups of circles reflecting beams of light. At the top, in three rows, letters of the alphabet connected by lines with two rows of letters below. Under the light bulbs, an inscription, 75. ROCZNICA ZŁAMANIA/ SZYFRU ENIGMY (75th anniversary of breaking Enigma codes).



face value	10 zł
metal	925/1000 Ag
finish	proof
diameter	32.00 mm
weight	14.14 g
mintage (volume)	52,000 pcs

Obverse: An image of the Eagle established as the state emblem of the Republic of Poland. Above the Eagle, an inscription, RZECZPOSPOLITA/ POLSKA. In the background, a stylised Enigma cipher machine operation diagram and a stylised inscription, ENIGMA, emerging from the composition of lines. Under the diagram, on the left, the notation of the year of issue, 2007. At the bottom, an inscription, 10 ZŁ. The Mint's mark, $\frac{m}{w}$, under the Eagle's left leg.

Reverse: A stylised labyrinth of connections referring to the operation of the Enigma cipher machine. In the centre, an inscription, ENIGMA. Below, an inscription, 1932, inverted by 180 degrees. In the rim, an inscription, 75. ROCZNICA ZŁAMANIA SZYFRU ENIGMY (75th anniversary of breaking Enigma codes).

On the edge: An inscription, MARIAN REJEWSKI, HENRYK ZYGALSKI, JERZY RÓŻYCKI, separated by stars.



face value	2 zł
metal	CuAl15Zn5Sn1 alloy
finish	standard
diameter	27.00 mm
weight	8.15 g
mintage (volume)	900,000 pcs

Obverse: An image of the Eagle established as the state emblem of the Republic of Poland, at the sides of the Eagle, the notation of the year of issue, 20-07, underneath the Eagle, an inscription, ZŁ 2 ZŁ, in the rim, an inscription, RZECZPOSPOLITA POLSKA, preceded and followed by six pearls. The Mint's mark, $\frac{m}{w}$, under the Eagle's left leg.

Reverse: A stylised rotor wheel of the Enigma cipher machine. At the circumference, an inscription, each letter in a circle, REJEWSKI RÓŻYCKI ZYGALSKI. In the rim, an inscription, 75. ROCZNICA ZŁAMANIA SZYFRU ENIGMY (75th anniversary of breaking Enigma codes).

On the edge: An inscription, NBP, eight times repeated, every second one inverted by 180 degrees, separated by stars.

Coin designer: Ewa Tyc-Karpińska

*Information on the purchase of coins is provided at:
www.nbp.pl*

Coins struck by the Mint of Poland plc. in Warsaw.

Printed by NBP Printing Office

Coins

75th Anniversary of Breaking Enigma Codes



On 21 March 2007, the National Bank of Poland is putting into circulation collector coins commemorating the 75th anniversary of breaking Enigma codes, with face value amounting to:

- 100 zł – struck in proof finish in gold,
- 10 zł – struck in proof finish in silver,
- 2 zł – struck in standard finish in Nordic Gold alloy.

The history of Polish contribution to World War II is generally known. However, relatively little is known about the Polish role in the "battle for secrets", i.e. in the reconstruction of the "Enigma", a German cipher machine, and in the development of apparatus that allowed the decryption of the code that was changed by the Germans on a daily basis. The structure of the replica was based on rotating cylinders with the letters A-Z on the circumference and on plugs providing an indefinite number of possible solutions. Without this apparatus, any attempts to decrypt the current key based on a small number of the messages would have been vain. Moreover, German land, marine and air forces used different codes.

At first sight, the Enigma encryption machine resembled a slightly more complex typewriter. After the letter key was pressed, an electric impulse passed through the complex circuit inside the machine (the circuit changing each time a key was pressed) and illuminated another letter on the parallel panel. Pressing the same key for a number of times resulted in different output letters (p → a, pp → z, ppp → j), since the rotors with letters turned each time similarly to a counter: full rotation of the first rotor shifted the second rotor by one letter, etc.

The Enigma was programmed every day in a different way and according to the key:

I V III DMR EY JL AK NV FZ CT HP MX BQ GS

This meant that out of five rotors with different internal circuits, rotor I was to be put in position D, rotor V in position M and rotor III in position R and outlets E and Y, J and L, etc. were to be connected by cables. The electric impulse passed the rotors twice. The receiver entered the encrypted text on his own Enigma with identical rotors and plugs position and read the output text on the illuminated panel (the rule presented above was reversed, i.e. a → p, z → pp, j → ppp).

The works on the Enigma were carried out by three young mathematicians engaged by the Polish counter-intelligence, graduates from Poznań University: Marian Rejewski, Jerzy Różycki and Henryk Zygalski, who specialised in the encryption theory. In the 1930s, they developed the mathematical basis of the Enigma and the apparatus for the deduction of the current settings of the machine's rotors and plugs.

In July 1939, the Polish Cipher Bureau, aware of the approaching German attack, informed the British and French intelligence of its

achievements. It also provided them with Polish replicas of the machine and the description of the apparatus designed for deducting the current position of the Enigma, so-called "bombs", i.e. a set of six Enigma subassemblies moved by an engine until they tracked the correct key. This was where the "computer" stopped.

It turned out that the Polish team had better results in the decryption of Enigma codes than the British and French intelligence, which were stuck in a deadlock in this respect. Polish solutions brought this situation to an end. The British established a decryption centre at Bletchley Park, about 70 km from London, with a view to breaking the Enigma codes. The Centre personnel intercepted German secret messages and decoded them. The Polish research was continued under the "Ultra Secret" programme, which at the end of the war was implemented by approximately 10,000 people working in Bletchley Park. Fortunately, Luftwaffe ciphers were relatively easy to break and already in the summer of 1940 they were effortlessly decrypted. This was crucial during the Battle of Britain: Sir Hugh Dowding, the commander-in-chief of the British RAF, knew exact daily operational plans of the Luftwaffe, as well as dates and targets of the attacks, which allowed him to efficiently use the small number of RAF fighters.

The "Ultra" programme, with a well-organised communications network (Special Liaison Units), also played an important role in the later victorious campaigns of the allies. The greatest problem was the decoding of the complex encryption system used by German submarines. The capture of U-110 submarine led by Captain Julius Lemp, on 2 May 1941 (the submarine torpedoed the Athenia liner at the beginning of the war), helped to solve this problem. It allowed the British to intercept Enigma together with daily keys necessary for the longer cruise of the U-boat. The key served to decode the correspondence of U-boats with their operating centre and to understand German strategy and tactics. Owing to that the German fleet previously controlling the Atlantic was eliminated quickly. Marshall Erwin Rommel's defeat in the Northern Africa was the result of the fact that, inter alia, the allies, who knew the lanes of German and Italian supply ships, sank only those that carried fuel and ammunition. "Ultra" also contributed to many victories on land. For instance, General Bernard Montgomery during the battle of El Alamein was kept informed on the operational plans of Marshall Rommel and on the condition of his troops. After the invasion on France, in August 1944, allied commanders learnt in advance about Hitler's order on cutting off the US army that attacked to the south. Consequently, the German offensive was stopped, which resulted in the defeat of Hitler's army in the Falaise Pocket and in their retreat from the territory of France.

The existence of the "Ultra Secret" programme and the role of Polish mathematicians in the creation of the decryption machine remained publicly unknown for many years. The allies

made the Polish share in the breaking of Enigma codes confidential. Until the end of the war, the Germans were unaware of the fact that the Enigma became worthless as a correspondence encryption mechanism.

Only in 1973, General Gustave Bertrand published his memoirs where he objectively presented the role of the Polish team in the solution of Enigma's mystery. He emphasised the fact that without the Polish team, the "Ultra" programme for the decryption of German secret messages would have never come into existence.

In 1978, Ronald Lewin published a detailed report on the breaking of Enigma codes ("Ultra Goes to War. The Secret Story"). He did not fail to mention the three Poles, without the knowledge and invention of whom the war might have ended in a different way. The later Western monographs never disregard the Polish role in the solution of Enigma's mystery. As far as Polish literature is concerned, Władysław Kozaczuk published a monograph entitled "W kręgu Enigmy" (Warsaw 1986), which contained memoirs and documentation of Marian Rejewski (deceased in 1980). In Bletchley Park, a commemorative plaque was unveiled to pay tribute to the Polish cryptologists.

According to Jan Nowak-Jeziorański, head of the Polish section of Radio Free Europe in Munich, the breaking of Enigma codes is the largest Polish contribution to the victory in the World War II. Also the US presidents, George Bush and Bill Clinton, when visiting Poland, mentioned the breaking of Enigma codes as one of the greatest Polish merits in combating the Third Reich.

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All coins issued by the NBP are legal tender in Poland.